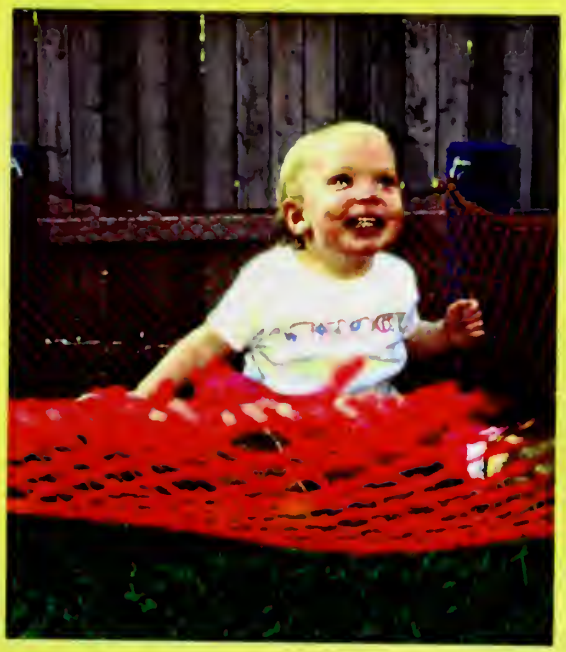
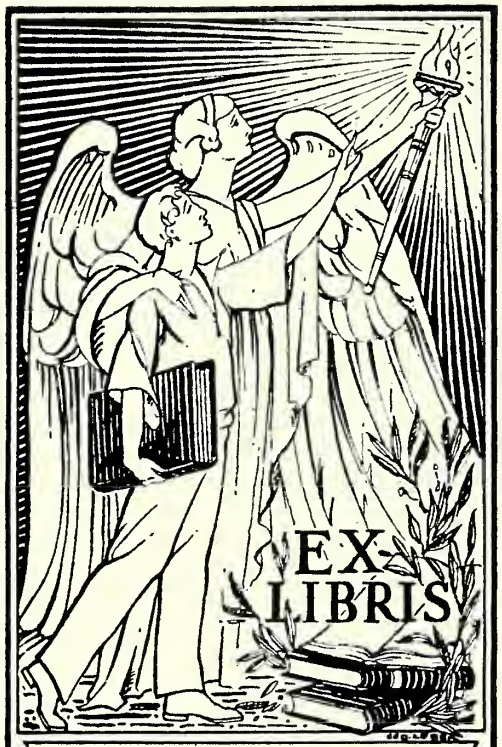


DEVELOPMENTAL GUIDELINES

FOR INFANTS WITH VISUAL IMPAIRMENT

A MANUAL FOR EARLY INTERVENTION

Amanda Hall Lueck, Ph.D. Deborah Chen, Ph.D.
Linda S. Kekelis, Ph.D.



Developmental Guidelines for Infants with Visual Impairment

A Manual for Early Intervention

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INTRODUCTION

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Acknowledgments

This manual draws upon the work of many fine authors, researchers, and practitioners. We would first like to thank all those cited in this manual, names too numerous to mention here, for contributing to our understanding of the development of infants with visual impairment.

A special thanks is extended to David Warren from the University of California, Riverside, whose books on visual impairment in childhood provided the inspiration to bring research and practice together.

Every work must be considered within the context of its times. To be certain that the manual reflects current best practices, it was reviewed by professionals from diverse backgrounds familiar with different aspects of development of infants with visual impairment from various perspectives. We would like to thank these people for the care with which they reviewed the manual and for their excellent input and guidance:

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Our deepest appreciation and gratitude go to Sheri Moore, Ed.D., Director of this project for the American Printing House for the Blind, whose persistence, faith, and encouragement caused this work to be written and brought to completion.

We have had the pleasure and honor to meet and work with many infants with visual impairment and their caregivers over the years. This book could not have been written without their help. We must thank them for teaching us about visual impairment in infancy, but we must also thank them for teaching us about patience, courage, love, and compassion.

* * * * * *

This book is dedicated to infants with visual impairment, their caregivers, and the professionals who serve them.

Amanda Hall Lueck
Deborah Chen
Linda S. Kekelis

Overview of the Manual

Purpose

This manual presents developmental guidelines for infants with visual impairment from birth to 24 months who have a wide range of vision loss in order to assist professionals as they work with families to support the development of these children.

This manual describes what is known about the development of infants with visual impairment based upon research and empirically-based observations. It was written for professionals who work with infants with visual impairment, exploring issues that are critical to understanding the effects of visual impairment on infant development. Merging research with practice, the manual also suggests intervention approaches that support the developmental progress of infants with visual impairment.

Method

Recent research and intervention methods with infants with visual impairment have been reviewed and summarized in two ways:

Narrative Chapters present specific intervention concerns.

Developmental Charts present critical developmental indicators.

The **Narrative Chapters** review current knowledge about the impact of vision loss in selected developmental areas. These chapters identify potential areas for intervention, emphasize guidelines to facilitate early development, and introduce strategies or resources to consider. Within this portion of the manual, the **Opportunities for Learning** section lists conditions that promote progress in a developmental area for infants with vision loss. Norris, Spaulding, and Brodie (1957), in their landmark study of blindness in children, emphasized that infants learn in the context of mutually satisfying interpersonal relationships in daily living, and "teaching" by caregivers occurs within those interactions. Families and early interventionists should make every effort to provide learning opportunities that facilitate progress.

The **Developmental Charts** delineate indicators of developmental processes that must be monitored and encouraged for infants with vision loss. Selected milestones are based upon what is known about infant development in general and upon specific research regarding the development of infants with vision loss. Although there are gaps in current knowledge as well

as problems in drawing conclusions and making generalizations from available research (Warren, 1994), a reasoned compilation of this information should prove valuable when selecting goals and objectives for intervention.

Summary Sheets have been prepared for use with individual infants in instructional programs.

They include:
Specific intervention concerns based upon the Narrative Chapters.

Summary of developmental behavior derived from the Developmental Charts indicating an infant's strengths and areas for determining appropriate goals and objectives within daily routines.

Norris, M., Spaulding, P.J., & Brodie, F.H. (1957). *Blindness in children.* Chicago: University of Chicago Press.

Warren, D.H. (1994). *Blindness and children: An individual differences approach.* New York: Cambridge University Press.

Organization of the Manual

Developmental Areas

There are six sections to this manual corresponding to the following developmental areas:

- Social-Emotional Development
- Communication Development
- Cognitive Development
- Fine Motor Development
- Gross Motor Development
- Functional Vision Development

Narrative Chapters

The Narrative Chapters for each developmental area address critical issues pertaining to infants with visual impairment and provide an overall perspective of intervention concerns for these children. Information about the effects of vision loss on the development of skills and behaviors is discussed. The chapters vary in length depending upon the amount of information available and relevant to early interventionists and families. Guidelines for intervention are included in these chapters which have the following components:

Description	A working definition that describes the behavior investigated in each developmental area
Explanation	A concise description of skills and behaviors addressed in each developmental area as they relate to infants with vision loss
Intervention Concerns	A detailed discussion of concerns specific to infants with vision impairment and possible ways to address them
Opportunities for Learning	A list of circumstances that promote the growth of infants with visual impairment in a particular developmental area

Developmental Charts

Charts for each developmental domain are organized into major underlying processes with specific indicators of those processes. The indicators have been sequenced in developmental clusters for infants with visual impairment. The sequence of development rather than expected ages for development have been emphasized in the charts. The charts can be reviewed to help determine critical skills and behaviors to consider for intervention. Suggestions for intervention are presented for each behavior listed in a chart.

Scant research and wide variability among infants with visual impairment make it extremely difficult to determine precise skill acquisition sequences. The sequences provided in the Developmental Charts reflect the skill acquisition sequence for normally sighted infants, and it has been assumed that this sequence is the same for infants with vision loss. Differences found in the literature have been noted in the charts.

The Developmental Charts are organized as follows:

Cluster - The sequence of indicators has been organized into developmental clusters. The clusters provide one or more skills and behaviors that can be considered for intervention at a particular period of development. **The precise age at which a cluster of skills is acquired will vary for each infant.**

Indicator - Skills and behaviors considered crucial to the developmental progress of infants with visual impairment are presented in the expected sequence of acquisition.

Source - The research studies, developmental scales, or other references from which the behavior and sequencing information have been derived are listed. The sources are summarized at the end of each Developmental Chart, describing the sample population studied by each source. A complete list of sources is referenced at the end of the manual.

Clarification - An expanded description of the skill or behavior under consideration is provided.

Suggestions for Intervention - Suggestions to promote a skill or behavior are given.

Summary Sheets

These forms summarize information obtained from the Narrative Chapters and Developmental Charts related to specific intervention concerns, areas of strength, and areas to target for development. This information can be used to determine instructional goals and objectives. A hypothetical profile of two infants with visual impairment along with completed Summary Sheets for those infants are provided as guides in the use of these forms.

Rationale for the Developmental Charts

Selection of Indicators

Current research with infants with visual impairment was reviewed to determine behaviors for inclusion in the Developmental Charts. Selected items were matched, whenever possible, to closely related items from the Bayley Scales of Infant Development, the BSID (Bayley, 1969, 1993). This instrument, designed to measure the developmental progress of normally sighted infants, has been subjected to rigorous standardization procedures with a large and varied population of infants in the United States. Some items could not be matched to the BSID since they were not used as items on those scales. In such cases, other available reference sources are presented. In some instances, developmental data were not available for certain items, but the items were included since they were considered relevant to infants with visual impairment.

The sequence of behaviors in the Developmental Charts has been ordered according to the item sequence on the latest version of the BSID which has a sound research base. It has been assumed that the developmental sequence of skills for infants with visual impairment follows the same course as that of normally sighted, typical infants, unless research evidence has shown otherwise. When this has been the case, relevant research data has been incorporated into the Developmental Charts. Items not found on the BSID were placed in sequence using best available data.

Selection of Clusters

The *sequence* of skill acquisition has been emphasized rather than the age of skill acquisition in the Developmental Charts since age level data for infants with visual impairment are not available for most skills and behaviors listed and the use of chronological age for evaluation purposes is questionable in any case. Available data for infants with visual impairment often cannot be used definitively for many indicators on the Developmental Charts since the administration protocols for many items do not use the precise administration methods and materials used by the reference sources. Furthermore, age ranges for skill acquisition are often quite broad when available, reflecting the great heterogeneity among infants with visual impairment due, in part, to variation in degree of vision loss, age of onset of visual loss, and additional disabilities. The presentation of these broad age ranges can be difficult to interpret and provide little practical guidance when determining goals and objectives for intervention.

To provide some guidance to early interventionists and caregivers, clusters representing the earliest developmental period in which a skill or behavior has first been observed in normally sighted infants have been incorporated into the Developmental Charts. Indicators have been placed into the earliest developmental cluster in which the specific skills and behaviors have been documented to emerge in *normally sighted infants* based upon available data sources. When these data were not available, data for emergent skills for infants with visual impairment were used to determine indicator placement into clusters.

Clusters have been determined using data from normally sighted infants as the guide. In some instances, indicators for a cluster on a particular chart were not available and that cluster was not included in the chart.

Cluster 1: birth to 3 months
Cluster 2: 4 to 6 months
Cluster 3: 7 to 9 months
Cluster 4: 10 to 12 months
Cluster 5: 13 to 15 months
Cluster 6: 16 to 18 months
Cluster 7: 19 to 21 months
Cluster 8: 22 to 24 months

Again, it must be emphasized that the actual ages in which the clusters occur in infants with visual impairment will vary and cannot be predicted for individual children. Therefore cluster ages have not been included in the Developmental Charts.

Use of the Clusters

Important to note is that the clusters cannot be used to determine expected age of attainment. They are the earliest age at which specific behaviors have been documented in normally sighted infants, and for many infants in that population, the skills and behaviors will appear at later ages.

The clusters can be used to determine when early interventionists should begin to examine specific skills and behaviors in order to consider the introduction of intervention strategies to promote the development of those behaviors. Behaviors will then be encouraged at the appropriate developmental juncture, neither too early nor too late. This is in keeping with the use of selected interventions (scaffolding techniques) that support developmental growth by providing assistance in the next developmental steps for infants (Vygotsky, 1978). For each process, the developmental cluster for an infant can be determined by identifying the skills and behaviors that the infant has attained. Then skills and behaviors within that developmental cluster or at the next developmental cluster can be used as guides when devising an intervention program for a child. It should be noted that some infants may have skills and behaviors in more than one cluster in a developmental process since these clusters serve only as guides, and developmental progression for individual infants can vary.

Organization of Manual References

Bayley, N. (1969). *Bayley Scales of Infant Development* New York: Psychological Corporation.

Bayley, N. (1993). *Bayley Scales of Infant Development.* Second Edition. San Antonio, TX: Psychological Corporation.

Vygotsky, L.S. (1978). *Mind and society.* Cambridge: Harvard University Press.

How to Use this Manual

This manual provides background material about developmental concerns for infants with visual impairment and suggests how to begin to address those concerns in intervention programs. It can be used as a guide in designing goals, objectives, and instructional strategies for infants with visual impairment in intervention programs. Specific information about the intended use of this manual follows:

- This manual is designed to be used as a **reference for professionals** who work with infants with visual impairment.

- Information in this manual applies to **infants with visual impairment from birth to two years of age**. Developmental references have been limited to this time frame in order to treat each topic in depth. While professionals may find some ideas in this manual useful for working with older children with visual impairment, it should be remembered that functional skills selected for discussion and approaches emphasized for intervention are geared for infants.

- **A thorough review of the background information and intervention concerns provided in the Narrative Chapters is strongly recommended.** This information provides reasons for suggesting the intervention approaches listed in the Developmental Charts and describes specific concerns for infants with visual impairment.

- Professionals may find it helpful to **present relevant information verbatim or in summary form to caregivers** depending upon specific needs and circumstances.

- **Materials and instructional strategies for infants with low vision often differ from those used for infants who are totally blind.** Examples within the manual provide applications to infants with visual impairment in general. An assumption has been made that the reader will understand when approaches are directed to a specific target group of infants with visual impairment. Less obvious or critical differences have been noted in the text, however.

- **Items on the Developmental Charts are indicators of underlying developmental processes and can be used as a guide for curriculum development by trained professionals familiar with general infant development.** The Developmental Charts are not meant to be used as a complete curriculum of all skills and behaviors that need to be acquired by infants with visual impairment.

- **The Developmental Charts are not intended to be used as a formal assessment tool** since 1) there are no reliability and validity data for the charts as written for infants with visual impairment and 2) they are not exhaustive of all skills and behaviors that should be examined in a developmental assessment of infants with visual impairment.

- **Since this manual is NOT meant to be used as a developmental assessment of infants with visual impairment, items on the Developmental Charts can be incorporated into goals and objectives of intervention programs for individual infants.** It is all right to use specific items, expand them, or modify them as they are incorporated into the daily routines of infants with visual impairment.

- **The clusters in the Developmental Charts can be used to determine which skills and behaviors are likely to emerge at a particular developmental stage and where to target intervention strategies.** A cluster was created by coalescing skills and behaviors that are likely to emerge at about the same stage in typical infants. This is intended to help professionals select areas to consider for intervention as they look at skills acquisition within a cluster and in surrounding clusters for individual infants.

- **It is expected that infants may exhibit skills in more than one cluster for a developmental process.** A cluster is a general construct based upon empirical findings that has been formulated to assist professionals in determining skills and behaviors to target for intervention for particular infants. The precise developmental pattern for every infant, with or without visual impairment, is unique. Professionals must attempt to understand every infant's unique developmental pattern and the complex set of factors that contribute to this unique pattern in order to reasonably determine skills and behaviors to target for intervention.

- **The clusters in the developmental charts cannot be used to determine developmental ages for infants with visual impairment.** Information about the age ranges used to determined the clusters in the Developmental Charts has been supplied in the chapter describing the Organization of the Manual in order to provide background information regarding the formulation of the charts for research purposes. Earliest age levels at which skills or behaviors were noted to emerge in typical infants were used to determine the clusters. Most typical infants will not develop the skills at the early ages levels used to formulate the clusters for many items in the Developmental Charts since average ages were not used. Furthermore, many of the items on the charts selected from standardized assessment tools have been altered substantially to reflect a general underlying developmental process. Due to this type of modification, the developmental ages derived from original standardization data no longer apply. **It is strongly urged that professionals using the Developmental Charts do not rely on the age ranges used to formulate the clusters when working with individual infants since they do not represent developmental age ranges for infants with visual impairment.**

- The indicators in the charts represent skills and behaviors of underlying processes listed in developmental sequence. In many instances, **infants may demonstrate skills and behaviors in a Developmental Chart that are not identical to the item listed but are still indicative of that emerging underlying process.** For example, on the Cognitive Development Chart, "Plays with rattle" indicates that an infant attends to a sound-making toy that can be held in the hand, and the infant explores the toy by looking touching, shaking, or holding. If the infant consistently does this with other sound-making toys, the infant demonstrates that underlying process.

- **Indicators are not available for all 8 Clusters on every Developmental Chart.** For example, in the Functional Vision Chart, most indicators of the process, Visual Attending Behaviors, emerge at very early ages (Cluster 1) in typical infants. The fact that indicators are not provided for every cluster does not necessarily mean that items are missing. It could mean, for example, that critical skill and behavior milestones that are indicators of an underlying process have not been identified at that specific developmental stage based upon research studies or empirically-based observations.

- **Summary Sheets can be used with individual children to monitor progress and to supply information about each child's learning style** that can assist in determining appropriate intervention strategies.

Basic Premises of this Manual

Introduction

Visual information to the brain far surpasses input transmitted from the rest of the body, with vision playing a major role in early development (Gesell, 1967). For infants with visual impairment, this sensory input is reduced or absent, and special attention is required to help these children understand and interact with their environment, to promote effective communication, and to encourage independent movement.

Development involves a series of progressive changes over time as a result of complex interactions between the infant and the environment. The goal of early intervention is to provide a systematic approach for guiding infants with visual impairment along their own developmental paths within the context of their families and communities.

Conceptual Framework

This manual draws from two developmental theories that underscore the importance of early intervention.

The transactional model (Sameroff & Chandler, 1975) considers developmental outcomes to be a consequence of reciprocal interactions between the infant and the caregiving environment. **The infant, family, and environment influence each other, and an infant's optimal development is the result of ongoing and successful adjustments in these relationships.** Interventions must be tailored to fit the individual abilities, interests, and needs of infants with visual impairment within the context of their families, home, culture, and community.

Next, according to Vygotsky (1978), the **difference between what an infant can do independently and what that infant can accomplish with caregiver assistance is considered to be the next developmental step for the infant** (i.e., the infant's *zone of proximal development).* **The development of a visually impaired infant may be facilitated by a caregiver's careful use of selected interventions (called *scaffolding techniques)* that support the infant's participation in and understanding of the environment.** The role of early intervention is to assist in identifying and using *scaffolding techniques* that meet the learning needs of individual infants. These techniques may include the use of prompts, material or activity adaptations, or environmental modifications.

Early Environments and Learning

What infants learn and how they develop are influenced by their interactions with their families in their homes, and in other environments. **As early interventionists, our work is to identify the essential features of environments that support learning and development for all infants in general and for infants with visual impairment in particular.** This is not a simple task. Learning and development are extremely complicated processes, and infants learn in a variety of different environments. Moreover, our understanding of how infants with visual impairment learn is incomplete. We know that aspects of the caregiving environment are likely to support development and learning of young children. Research suggests that in the home environment, the levels of stimulation and support in families of children with visual impairment are similar to other families in general (Rock, Head, Bradley, Whiteside, & Brisby, 1994). Families have been found to respond to an infant's visual impairment by adapting the environment (e.g., to promote movement and exploration) and by participating in early intervention programs (e.g., to support functional use of vision and/or compensatory skills). These responses contribute positively to the home environment and to the infant's development (Dote-Kwan & Hughes, 1994). Blind infants may need opportunities to attend to their own sounds without distraction, to explore objects, and to develop tactile discrimination skills (Nielson, 1991). Environmental modifications and supported opportunities are essential to assist development of movement, exploration, and concept formation of infants with visual impairment (Head, Bradley, & Rock, 1990). Appropriate language input, maternal verbal responsiveness, and emotional support are related to the language development of infants with visual impairment (Dote-Kwan, 1995; Kekelis & Andersen, 1984).

Developmental Domains

Although developmental domains may be separated for research and assessment purposes, in infancy these areas are highly interrelated. Consider the relationship between an infant's social, cognitive, communication, and motor abilities. The emergence of one ability, (e.g., object permanence), may influence abilities in other areas (e.g., attachment, self concept, and locomotion). Social development of an infant can only be understood within the context of communication and cognitive abilities, and an infant's cognitive and social development are influenced by physical status and environmental factors (Odom, 1983).

Developmental milestones are behavioral indicators of underlying processes. For example, *walks without support* indicates increasing locomotor control and independence. *Feeding a doll* and *using words* indicate conceptual understanding in cognitive development as well as social abilities. Early intervention should provide experiences that encourage development of particular processes which may not occur naturally when an infant has a vision loss. **If developmental milestones are used as a curriculum guide without consideration of the underlying processes, infants will develop splinter skills rather than a solid foundation for learning.**

This manual presents each developmental area under a separate chapter for the purpose of focusing attention on the particular developmental needs and strengths of infants with visual impairment and as a foundation for creating appropriate interventions. In order to be most effective, **intervention objectives should be integrated within daily activities of an infant's natural routine,** and this is elaborated in the examples provided in the concluding chapter.

Critical Issues for Infants with Visual Impairment

Parents and early interventionists must be aware of a number of basic premises in order to effectively promote the development of infants with visual impairment.

- Infants with visual impairment, like all babies, are different from each other. In addition, differences (such as degree of visual loss, cause of visual impairment, age of onset of visual impairment, presence of other impairments, prematurity versus full-term, and family situations) lead to different courses and rates of development. It is risky to make hard and fast developmental statements that apply to every infant with visual impairment or to make firm statements that apply only to one subgroup of the visually impaired infant population such as infants who are totally blind. There are often exceptions to commonly-held suppositions, and ranges of achievement are incredibly broad. While additional research concerning general developmental patterns of infants with visual impairment will help promote our understanding of these issues (Project PRISM, 1996; Hatton, 1995), Warren (1994) stresses the need to consider individual differences when working with infants with visual impairment. With this in mind, **it is absolutely essential that each infant with visual impairment be treated as an individual.**

- Age comparisons with fully-sighted infants cannot be made with confidence, and age comparisons with other infants with visual impairment or total blindness must be made with reservation. **Therefore, age comparisons are not stressed in this manual. Instead, intervention concerns and developmental sequences that can provide guidance for programming for individual infants are emphasized.** Progress of these young children can be measured based upon attainment of behaviors and skills in a developmental sequence, but the rate of this progress can vary dramatically from child to child.

- **Risk Factors** are circumstances in an infant's life situation that may adversely affect growth in a developmental area. Parents and interventionists must carefully monitor growth and provide active learning opportunities for any infant with visual impairment, but this is especially important when any of the following risk factors are present:

  - Prematurity
  - Additional disabilities or medical needs
  - Prolonged hospitalizations
  - Minimal interaction with caregivers
  - Minimal opportunities for meaningful exploration of the environment

- Overstimulation or understimulation at early ages
- Delayed identification of visual impairment

♦ **Many factors contribute to an overall understanding of the unique needs of each visually impaired infant** including the family situation, developmental growth pattern, special medical circumstances or other disabilities, and the nature of the visual impairment.

♦ Many infants with visual impairment have **additional disabilities** which can include hearing loss, motor limitations, other health impairments, and/or cognitive delays. This manual primarily emphasizes the impact of visual impairment on development and can only serve as a starting point for understanding the complex and diverse developmental needs of infants with multiple disabilities. References related to infants with multiple disabilities including visual impairment have been listed in the Appendix.

♦ The developmental charts have been divided into domains and processes to help facilitate understanding of the complex array of developing skills and behaviors as infants mature. It must be emphasized, however, that **developmental domains are interconnected** in all infants, and particular attention must be given to this interrelationship when working with infants with vision loss. It is important to understand an infant's level of functioning in each domain and how the level of functioning in one domain affects the performance of skills and behaviors in other areas.

♦ When learning reaches a plateau in one developmental domain, it may not be appropriate to strive immediately for continued progress in that area. Since developmental domains are interconnected, **the infant may need to make learning strides in other developmental domains** and integrate that learning before further progress can be made in an initial area targeted for intervention.

♦ **Every infant has an individual personality, temperament, and learning style.** All infants have specific interests, strengths, and learning needs. The role of early intervention is to build on an infant's interests and strengths in order to address specific learning needs as identified by the family and professionals. For example, some infants with visual impairment may like singing and music activities but dislike touching and handling objects in a systematic manner. An infant's preference for auditory input can be used to encourage tactile exploration by adding songs to object discrimination activities.

♦ **Encouraging a close relationship between caregivers and infants** is vital for optimal growth and development for infants with vision loss. Suggestions to promote this relationship must build upon the strengths and interests of caregivers.

♦ Every family has specific values, priorities, and concerns about their infant's development. Every professional has a particular philosophy of early intervention. **Developing family/professional collaboration takes time, communication, and mutual respect.**

Building this relationship becomes even more complicated when the professional and family are from different cultural backgrounds (Lynch & Hanson, 1992). First, a professional must be aware of his/her beliefs about intervention practices, understand the primary responsibility of families in their infants' development, and be clear about his/her role as an early interventionist. Next, the early interventionist should gather information about the family's perspective on their infant with visual impairment in order to collaborate in developing and implementing meaningful and motivating interventions.

- **Educating the infant's family about the developmental needs of infants with visual impairment in general and the family's child in particular** is a necessary part of any intervention program.

- Infants with visual impairment are first and foremost infants. They need to get dirty, explore their environment, make a little mischief, and take some spills and bumps as they grow and learn. It is natural to want to protect children from harm, but too much protection can restrict an infant's opportunities to learn. **Caregivers and interventionists must work together to set appropriate safety limits for children that do not dampen experiential learning opportunities.**

- Learning environments that are more than adequate for fully-sighted infants may not provide sufficient information or motivation for those with vision loss. **Optimal learning environments and specific training strategies must be carefully selected** for infants with visual impairment at different developmental stages.

- **Determining an infant's visual skills** from evaluations by eye care providers and from functional evaluations of vision use by teachers of the visually impaired must be considered prior to the selection of intervention goals and the determination of instructional strategies to meet those goals. Determining any changes in functional vision skills is an ongoing part of early intervention programs for infants with visual impairment.

- **Infants with low vision require attention to all developmental domains as do those who are totally blind in order to ensure optimal progress.** Attention to vision functioning alone may cause other developmental needs related to low vision to be ignored.

- Assistance in **integrating and applying input from all sense modalities** is critical for infants with vision loss. This is important for infants with low vision as well as those who are totally blind.

- Many needs of infants with visual impairment cannot be inferred through usual communication strategies dependent upon vision (e.g., eye contact, gestures, pointing, imitation of facial expressions). **Alternate communication strategies** used by infants must be identified and interpreted, and optimal methods to be used by caregivers to encourage communicative competence must addressed.

- In general, experiences for infants with visual impairment during the course of daily routines can be guided by several principles:

  - Infants with visual impairment benefit from **active engagement** with a variety of objects and materials that promote conceptual awareness, interest in their surroundings, and acceptance of a variety of sensory experiences.

  - A **broad range of experiences with real, rather than representational objects** (e.g., a rabbit is very different from a stuffed rabbit toy or a plastic rabbit) is recommended for infants with vision loss.

  - Infants with visual impairment should be supported to **learn about the organization of their surroundings during daily routines** (i.e., where things belong, where things come from, where they are placed when an activity is completed).

  - If a **structured experience to teach a specific skill or behavior is necessary, generalization of that skill is critical.** This can be accomplished by encouraging the infant to apply the skill during the course of daily routines.

- Research has shown that a system of least prompts is effective in teaching children with a variety of disabilities (Doyle, Wolery, Ault, & Gast, 1988). Instruction should **begin with the prompt that provides the least amount of assistance.** Here is an example in which the instructional goal is to encourage an infant to use a xylophone stick to bang. The strategy first involves using the natural cue (e.g., handing the infant the stick). If the infant responds with an action other than banging or does not bang at all, then the least intrusive prompts are used (e.g., saying "bang, bang, bang" and demonstrating with another stick.) If the infant still does not respond by banging, the next level prompt is introduced (e.g., tapping the infant's hand holding the stick and saying "bang, bang"). This process is followed until the most intrusive physical prompt -- physical guidance -- or hand-over-hand assistance is needed. If an infant requires a full physical prompt in order to respond appropriately, care should be taken to fade the amount of assistance once the infant is responding consistently. For example, if the infant grasps the stick and bangs the xylophone with full hand-over-hand assistance, then the adult should provide less physical guidance by holding the infant's wrist or elbow, or by using a physical prompt such as patting the infant's hand. A backward chaining process should be used to fade assistance from the most to the least amount required for the infant to participate in the activity.

  Use of this sequence is more likely to encourage an infant's active participation and less likely to promote dependence on prompts. The following list of prompts, from least to most intrusivc, has been adapted for infants with visual impairment.

Hierarchy of Prompts

Natural Cue	Offering an object for the infant to see or feel elicits the desired action.
Gestural Cue	Movement or gesture indicates the desired action to the infant (e.g., pointing) and elicits the desired response.
Direct Verbal Cue	Verbal request for the action elicits desired response by the infant.
Modeling	Demonstration of the action to the infant elicits the desired response. Totally blind infants should be encouraged to place both hands on the modeler's hands to feel the movement.
Physical Prompt	Physical contact is provided which can range from touching the infant's hand to guiding the infant through part of the action to elicit the desired response.
Physical Guidance	Interventionist's hand is placed over the infant's hand in full physical contact to complete the desired action. Also known as hand-over-hand assistance.

- **Referral to specialists** should be made as appropriate. Infants with visual impairment often have concerns related to their visual or multiple impairments that can best be addressed by professionals with specialized training. For example, teachers of children who are visually impaired can assist with functional vision assessment and habilitation as well as developmental concerns related to visual impairment. Development of concepts necessary to understand space and spatial relations as well as training to travel independently require the assistance of orientation and mobility specialists. Unusual problems in hand use or gross motor control require consultation by occupational and physical therapists, respectively. Vision assessment, treatment for eye conditions, and/or possible prescription of optical corrections require consultation by eye care specialists. Difficulties encountered in infants' communicative competence and/or language input from their caregivers requires consultation by speech-language therapists. These specialists should have expertise in working with infants. Various service delivery options are available to implement recommendations by these professionals. Those selected will depend upon the organization of each intervention program.

- **Intervention for infants with visual impairment requires a team approach with the caregivers serving as an integral part of the team.** Selected interventions for an individual infant must be developed in collaboration with the family. Discipline-specific objectives (e.g., from the teacher of children with visual impairment, orientation and mobility specialist, physical therapist, occupational therapist, or speech and language therapist) must also be integrated into the family's daily routine. With this approach, the infant is more likely to have repeated opportunities for learning, and the family will understand the purpose of various intervention strategies.

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VISUAL IMPAIRMENT IN INFANTS

Visual Impairment in Infants

Normal Infant Visual Development

In normal infant visual development, a newborn's visual system, although immature, is ready to function at birth, and some capabilities approach near adult-levels in the first 6 months of life.

- Estimates of **visual acuity** (i.e., the ability to discriminate fine details) vary depending on the assessment technique employed, with reported measures of visual acuity ranging from 20/800 to 20/100 at 2 weeks and 20/100 to 20/20 by about 6 months (Haith, 1986; Hoyt, Nickel, & Billson, 1982).

- **Visual field** (i.e., the area that can be seen) in infants is limited at birth in all directions of gaze and expands slowly until 2 months. From 2 months to one year, the visual field increases rapidly, with the upper field reaching adult size and the horizontal and lower fields still smaller than in adults (Mohn & Hof-van-Duin, 1986).

- **Newborn infants attend to form, object, and face**, are **sensitive to bright light**, and are **more visually responsive under low illumination** (Glass, 1993).

- Evidence suggests that **accommodation** (i.e., the ability to focus on objects at different distances) improves significantly between 1 and 3 months of age (Haith, 1986; Hyvarinen, 1988).

- **Most newborn infants can focus on objects at a distance of 2.5 feet, although maintaining attention improves with age** (Glass, 1993).

- **Stereopsis** (i.e., the ability to perceive the relative distance of objects based upon differences in the images received by each eye that result from spatial displacement) is present at 2 to 3 ½ months (Haith, 1986; Hyvarinen, 1988).

- **Color vision** mechanisms are probably functioning from birth or shortly thereafter, but colors must be very saturated (vivid) and targets must be fairly large for young infants to respond due to overall low sensitivity of these mechanisms (Allen, Banks, & Norcia, 1993; G. Haegerstom-Portnoy, personal communication, February 1, 1996; Volbrecht & Werner, 1987).

- At birth, the infant can best see objects of high contrast, with **contrast sensitivity** (i.e., the ability to detect small differences in the brightness of adjacent surfaces) improving during the first year of life, and reaching adult levels by three years of age (Hyvarinen, 1988).

Identification of Visual Impairment in Infants

Since milder functional impairments are difficult to detect and may not be picked up in early screening procedures, identification of visual impairment in infants is likely to involve those with more severe visual loss. Neurobehavioral adaptations to diminished vision, defined by Good and Hoyt (1989) as reactions to a disease process, can compensate for a visual disability and can be helpful in diagnosing visual impairment and its causes in young children. These adaptations include such behaviors as eye pressing, over-looking, roving eye movements, head turning, nodding, and sensory nystagmus (i.e., usually rapid, involuntary eye movements that can be side-to-side, up and down, and/or rotary, related to impaired vision). In addition to recognizing and understanding these behaviors in terms of their diagnostic significance, it is important for early interventionists to work together with medical specialists to explain the biological causes and behavioral relevance of these adaptive behaviors to caregivers and staff working with infants with vision loss (Good & Hoyt, 1989).

Definitions of Visual Impairment

Legal blindness in the United States is considered to be vision that is 20/200 or less in the better eye with best optical correction or a field of vision constricted to a diameter no greater than 20 degrees. Due to the immaturity of the visual system, definitions of visual impairment based on visual acuity and used for entitlement to social and other services are not applicable to infants in the first months of life. Reliable visual acuity measures based on assessment techniques providing information comparable to the standard Snellen visual acuity measure can be difficult to obtain for infants with vision loss at early and later ages, especially when assessing infants with multiple disabilities, and none is ideal for all circumstances (Teplin, 1995). While grating acuity scores can be obtained for infants with visual impairment using preferential looking and electrophysiological measures, direct conversion of grating acuity values obtained from impaired visual systems into equivalent Snellen acuity has been called into question (Hyvarinen & Appleby, 1996). Normative references have been developed from grating acuity measures for typical infants at different ages that can be used to determine visual impairment in infancy without using Snellen acuity values, however (Dobson, 1994).

The use of visual acuity alone to determine visual impairment does not take into account other factors that may be associated with visual loss and affect function such as visual field, accommodation, contrast sensitivity, and oculomotor function (Hyvarinen, 1985). Reduced visual field can also be used to determine visual impairment and to qualify individuals for social and medical services, yet visual field development is not yet complete at one year of age. Thus the determination of visual impairment based upon current definitions for entitlement using Snellen visual acuity and/or visual field is not appropriate for young infants and is difficult to obtain given current assessment procedures for all infants.

Furthermore, early interventionists must be certain that caregivers clearly understand the definition of legal blindness which can encompass moderate vision loss to total blindness and

that many factors affect the quality of visual function besides visual acuity (Teplin, 1995). **To foster appropriate expectations regarding visual capabilities for children, it is important to accurately describe an infant's visual functioning since many legally blind children have a great deal of vision for learning.**

Definitions of vision impairmcnt based upon the ability to perform functional tasks have been developed for children and adults in educational and rchabilitation settings (Bailey & Hall, 1990; Hyvarinen, 1985). A **functional definition of visual impairment** is warranted for infants, including those with mild visual loss that affects lcarning and performance. Such a definition must take into account visual performance in daily routines and visual learning requirements at various developmental levels.

Definitions

Visual Impairment	Any partial or total deficit in visual capacities that affects an individual's ability to learn or perform usual tasks of daily life, given that individual's level of maturity and cultural environment. Visual impairment cannot be corrected to normal with eyeglasses or contact lenses. **Vision loss** is used interchangeably with visual impairment in this manual.
Low Vision	A visual impairment that is severe enough to impede an individual's ability to learn or perform usual tasks of daily life, given that individual's level of maturity and cultural cnvironment, but still allows some functionally useful visual discrimination. Low vision ranges from mild to sevcre and excludes full loss of functional vision. **Reduced vision** is uscd interchangeably with low vision in this manual.
Total Blindness	Complete absence of vision which is often recorded as *No Light Perception* (NLP)
Functional Blindness	An absence of any useful vision which is often recorded as *Light Perception* (LP) when thc presence of light can be detected but its spatial distribution cannot be determined.

adapted from Bailey & Hall (1990)

Visual Impairment in Infants References

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SOCIAL-EMOTIONAL DEVELOPMENT

Social-Emotional Development

Description

Although the term "social-emotional" development is used frequently in developmental literature and early childhood special education programs, it is not easily defined as a single construct. Emotional development is identified by the infant's emotional reactions, feeling states, and emerging sense of self, which are nurtured within the social context of early interactions. Social development involves the ability to participate in early reciprocal interactions with primary caregivers and later, with peers during the second year of life. Clearly, social and emotional development are interrelated but separate areas.

Explanation

The single most important factor in emotional development is a responsive, loving caregiver. Developmental research suggests that the quality and consistency of an infant's early social experiences have a lasting impact on self-esteem and social competency. When an infant is visually impaired, several factors may influence the nature of these early experiences:

- Prolonged stay in the neonatal intensive care unit and/or frequent hospitalizations during the early years may interrupt the natural caregiving process.
- An infant's visual impairment may result in decreased or absent eye contact, gaze, or smiling as typical ways of responding to, initiating, and maintaining contact with the caregiver.
- An infant may respond in unexpected or misunderstood ways (e.g. quieting when interested in an activity or listening to the parent's voice).
- A caregiver, coping with the infant's diagnosis, medical interventions, and accompanying responsibilities, may be emotionally unavailable.

This chapter draws from multiple theories that emphasize the significant role of a primary caregiver in fostering healthy emotional development. As outlined on the following page, in the chart entitled *Theories of Emotional Development in Infancy,* the views of Ainsworth (1969), Erikson (1963), Greenspan (1985), and Mahler (1975) are particularly helpful in providing a framework for understanding the emotional needs of infants. These perspectives identify an infant's attachment to a significant caregiver and sense of autonomy as critical developmental processes in healthy emotional development. The chart at the end of the chapter includes key developmental indicators with suggestions for developing a responsive caregiving environment for infants with visual impairment.

Theories of Emotional Development in Infancy

Erikson	Greenspan	Ainsworth	Mahler
birth-12 months *Sense of trust* Infant develops view of world as safe and predictable because caregivers provide food, comfort, protection, and affection. This sense of security encourages the infant to initiate and participate in activities.	**birth-2 months** *Self-regulation and interest in the world* Infant is able to achieve and maintain a quiet alert state. **2-7 months** *Forming of attachment* Infant recognizes primary caregiver. **3-10 months** *Intentional communication* Infant attends to caregiver and environment.	**1-2 months** *Initial preattachment* Infant signal behaviors (crying, cuddling, smiling) engage caregiver's attention. **2-7 months** *Attachment in the making* Infant recognizes and responds differently to primary caregiver.	**birth-2 months** *Normal autistic* Infant only aware of caregiver as source to meet basic needs. **2-4 months** *Symbiosis* Infant establishes close relationship with caregiver and expands reciprocal interactions. **5-8 months** *Differentiation or "hatching"* Infant looks at and reaches for objects in the environment. May pull away when held. **8-15 months** *Practicing* Infant discriminates between people, begins to move out into the environment, and returns to caregiver periodically for reassurance.
12-36 months *Autonomy* Infant develops a sense of control through increasing developmental abilities (e.g, learning to feed self, exploring the environment, and performing some tasks independently).	**9-18 months** *Sense of self* Infant moves away from caregiver to explore environment. Checks in at regular intervals. Initiates activities and interactions based on needs and desires.	**7-24 months** *Clear-cut attachment* Infant shows strong preference for (by initiating contact with, reaching for, crawling to) caregivers. Shows fear of strangers and separation from familiar caregivers.	**15-24 months** *Rapprochement* Infant begins to return to caregiver more often to show objects and accomplishments. Alternates between being physically close to the caregiver and wanting to be by self in completing a task.

Attachment

The terms *bonding* and *attachment* are matching halves of the caregiver-infant relationship. Bonding refers to the parent's emotional tie to the infant (Klaus and Kennell, 1976) while attachment refers to the infant's emotional connection with a significant caregiver (Bowlby, 1982).

Infants develop an emotional attachment to a primary caregiver during the first year of life. After several months, they begin to have different reactions to their primary caregivers than to other people. At the same time, certain infant behaviors such as gaze, eye contact, smiling, and vocalizing engage the caregiver's attention and keep the infant in contact with the caregiver. A visual impairment and associated experiences may interrupt the typical process by which an infant develops an emotional attachment with a primary caregiver.

Temperament and Goodness of Fit

The concepts of temperament and goodness of fit provide a means of understanding an infant's behavioral style within the context of the caregiving environment. An infant's overall development is promoted when the caregiver's own temperament, caregiving style, and expectations are in harmony with the individual infant's abilities, needs, and characteristics.

Temperament refers to the infant's disposition or behavioral style (Thomas and Chess, 1977). Goodness of fit describes the match between the caregiving environment and the infant's abilities and disposition or behavioral style.

Certain patterns of caregiver-infant interaction and specific caregiving expectations or child-rearing practices may interfere with optimal development. For example, keeping a infant who is blind in a playpen for extended periods decreases essential opportunities for movement and exploration. Similarly, it may be a family's custom to provide total assistance with a child's self care skills, (e.g., feeding and dressing) until he or she shows initiative in these areas. However, the child with severe visual impairment will not develop a natural interest in these skills without models, encouragement, and practice. In making intervention recommendations, the early interventionist should balance respect for the family's values, priorities, and concerns about their child with professional judgement about essential and beneficial experiences for an infant's development.

Intervention Concerns

A primary goal of early intervention programs is to support a positive and mutually-rewarding caregiver-infant relationship. Caregivers may need support and encouragement in establishing a satisfying early relationship with infants who are visually impaired. Absence of infant eye contact decreases parental visual attentiveness to the infant (Rogers & Puchalski, 1984) as well as vocal

responsiveness (Rowland, 1983). Infants who are blind have been characterized as quiet and passive (Burlingham, 1964) and may be more irritable and less responsive (Chess & Fernandez, 1976; Rogers & Puchalski, 1984). Consequently, establishing reciprocal caregiver-infant interactions through **early and enjoyable turn taking is a significant intervention for infants with visual impairment and their families.** See the chapter on *Communication Development* for a discussion of specific strategies to encourage positive caregiver-infant interaction. An infant's healthy emotional development is promoted by the infant's ability to elicit caregiver attention (Goldberg, 1977) and a responsive caregiver who supports the infant's growing independence, particularly when infants have disabilities (Ulrey, 1982).

- It is essential to **help caregivers recognize, interpret, and respond to infant behaviors** in order to promote attachment behaviors. Infants with visual impairments may not demonstrate the range of behaviors that typically elicit and maintain contact with caregivers. The ability to interpret and respond to infant behaviors will build a caregiver's confidence and self-esteem in parenting. In turn, a caregiver's consistent responsiveness will promote an infant's sense of trust in the world.

  Considerations: Infant crying, smiling, cuddling and other signal behaviors attract the attention of and maintain closeness with the caregiver. Infants who are visually impaired may exhibit subtle, fleeting, or confusing signals. Careful observation and identification of these behaviors are critical. Predictable caregiving routines encourage an infant's interaction, support a caregiver's ability to respond to infant behaviors, and provide opportunities for enjoyable caregiver-infant interactions.

- Attachments to primary caregivers develop after the infant can discriminate familiar from unfamiliar people, resulting in fear of strangers and separation anxiety. Infants with visual impairment may require additional or **specific sensory cues to encourage discrimination and recognition of significant caregivers.** Infants who are blind demonstrate stranger anxiety during the second half of the first year (Fraiberg, 1970; Fraiberg & Freedman, 1964). However, reactions to separation from the significant caregiver may not be observed. Warren (1994) suggests without vision to maintain proximity, the infant who is blind becomes experienced in being separated from the primary caregiver. Positive attachment behaviors and stranger anxiety are indicators of attachment.

  Considerations: An infant's recognition of a significant caregiver may be encouraged by the use of a particular scent, familiar greeting, and/or usual way of holding or handling the baby. Consistent use of greeting and leave-taking rituals will promote an infant's awareness of a caregiver's presence and absence, develop opportunities for communication, and promote the infant's sense of trust.

- Strategies should be developed to encourage the infant with visual impairment to **move and explore the environment while maintaining contact with the caregiver.** When sighted infants actively explore environments, they constantly monitor the whereabouts of familiar

people (Fein, 1975) and check in visually with the caregiver (Carr, Dabbs, & Carr, 1975; Sorce & Emde, 1981). Infants who are blind may check in through verbal probes to maintain distal contact with their caregivers (Fraiberg, 1977; Rowland, 1983).

> Considerations: When the sighted infant becomes mobile, movements and eye contact allow the infant to check in with the caregiver. A severe visual impairment may not only inhibit the infant's natural motivation to move and explore but also limit the opportunities and means for keeping tabs on the caregiver. Interventions are needed to motivate the infant to move and explore and to let the infant know that the caregiver may be out of sight or physical contact, but still available. For example, develop games encouraging the infant to "find mommy" or to engage in vocal turn taking games.

- It is essential for an infant to **develop a sense of autonomy and competence**. Infants with severe vision loss will require specific opportunities for participating in developmentally appropriate activities and accomplishing everyday tasks. Caregivers may need support and encouragement to involve the infant who is visually impaired in everyday chores, to allow trial and error, and to support the infant's efforts towards independence.

  > Considerations: A team approach (involving professionals in orientation and mobility, visual impairment, and if necessary, physical or occupational therapy) may be needed to create environmental supports for an infant's participation in and completion of everyday tasks. In addition, simple modifications of the environment and small adaptations to daily activities may be helpful. For example, child-size furniture allows an infant to get up without help after a snack. Toys stored in shallow baskets or containers are easier to find than those stored in a toy box or chest. Caregiver concerns about the infant's safety can be addressed by child-proofing the house and providing supervised opportunities for the visually impaired infant to experience independence.

- Interactions and caregiving routines should fit the infant's temperament or behavioral style. A **goodness of fit** is created when a caregiver can adapt interactions and expectations to match an infant's preferences, abilities, and needs (Thomas, Chess, & Birch, 1970).

Research has identified nine different behaviors that contribute to an infant's disposition: activity level, rhythmicity, distractibility, approach-withdrawal, adaptability, attention span and persistence, intensity of reaction, threshold of responsiveness, and quality of mood (Thomas & Chess, 1977; Thomas et al., 1970). These characteristics are defined on the following pages in *Indicators of Infant Temperament* with examples of infant behaviors and suggestions for intervention.

Indicators of Infant Temperament

QUALITY	RATING	4 MONTHS	21 MONTHS	SUGGESTIONS FOR INTERVENTION
Activity Level or amount of motor activity	High	Splashes in bath. Bounces in crib.	Climbs on and off furniture. Enjoys active play.	Adapt the environment to encourage safe movement and exploration.
	Low	Very quiet in bath. Plays quietly and falls asleep in crib.	Enjoys quiet play and listening to music for extended periods.	Use music and action songs to encourage movement and communication.
Rhythmicity or regularity of physical needs (i.e., for food, sleep, elimination)	Regular	Regular sleep schedule at night.	Takes a nap everyday after lunch.	Develop a consistent caregiving routine for meeting the infant's physical needs. (e.g., mealtime and then nap, or listen to music and then go to sleep)
	Irregular	Wakes up at different times.	Nap time is unpredictable.	
Distractibility from ongoing activity (e.g., when fussing)	Distractible	Stops fussing if rocked or if caregiver sings.	Stops fussing when face is being washed if activity is made into a game.	Develop specific strategies for distracting the infant during a disliked activity (e.g., use movement, song, games, toys.) For example: infants who enjoy music will tolerate having their faces washed if caregivers sing "This is the way I wash my face." Complete a necessary but undesired activity quickly and provide physical comfort and support.
	Not Distractible	Stops fussing only after disliked activity is completed.	Cries when desired object is removed and rejects alternatives.	
Approach/Withdrawal response to novelty (e.g. foods, people, activities)	Positive	Enjoys new foods.	Approaches unfamiliar children at playgroup.	Introduce new experiences with the support of what is liked by and familiar to the infant. For example: infants who like movement will sit beside an unfamiliar peer in a rocking boat.
	Negative	Rejects new foods when first introduced.	Avoids unfamiliar children.	
Adaptability to changes in the routine or environment	Adaptive	Rejected new foods, accepts them now.	Responds to requests. Cooperates when getting hair cut.	Provide a predictable routine, familiar activities, as well as time, support, and repeated opportunities for the infant to become familiar with new situations. Assist the infant in responding to a request by providing verbal, auditory, tactile, or physical prompts as needed.
	Not Adaptive	Continues to reject new foods.	Does not follow requests. Protests during every hair cut.	

Indicators of Infant Temperament [Continued]

QUALITY	RATING	4 MONTHS	21 MONTHS	SUGGESTIONS FOR INTERVENTION
Attention Span and Persistence in activity	Long	Sucks pacifier intently and for extended periods.	Will keep trying to fit all blocks into posting box.	Provide opportunities for completing brief simple tasks. Focus the infant's attention by reducing distractions. Support the infant's attempts to complete a task by providing verbal, auditory, tactile, or physical prompts as appropriate. Provide verbal praise and positive feedback about the infant's efforts.
	Short	Spits pacifier out after a few seconds.	Gives up quickly if unable to get a block in posting box.	
Intensity of reaction (i.e. level of emotional responses)	Intense	Splashes vigorously in tub.	Cries loudly if desired object is removed.	Interpret the infant's behaviors as communicative and provide words to describe the infant's actions.
	Mild	Tends to be quiet in tub.	Reacts mildly to removal of desired object.	
Threshold of responsiveness to external stimulation	Low	Startled by loud sounds.	Laughs loudly when tickled.	Modulate sensory input to match the infant's sensitivity to sounds, touch, taste, and movement.
	High	Not bothered by loud sounds.	Has mild reactions to tickling.	
Quality of Mood or general disposition	Positive	Smiles at caregivers.	Delights in completing tasks.	Identify when the infant is active and alert, activities that are preferred, and most enjoyable interactions with caregiver. Increase opportunities for engaging in brief and pleasurable infant-caregiver interactions.
	Negative	Fusses when rocked.	Tends to be irritable and demands attention.	

Based on: Thomas, A., Chess, S., & Birch, H.G. (1970). The origin of personality. *Scientific American, 223,* 102-109

- As indicated in the chart *Indicators of Infant Temperament*, infants may display a combination of behavioral reactions that make caregiving either an easy and satisfying experience or a difficult and challenging task. Thomas and Chess (1977) investigated the temperament of infants without disabilities and infants with disabilities (mental retardation, visual impairment, hearing loss, physical disabilities, and other special needs). Their findings suggest that infants with disabilities are more likely to have irregular physical needs, to slowly accept new or unfamiliar things, people, or situations, and to have intense reactions and unpleasant moods. These irritable reactions and unpredictable patterns can challenge even the most responsive and sensitive caregiver.

  Considerations: Infants have different dispositions. Some are cooperative, predictable, and responsive, others seem uncooperative, unpredictable, and fussy, while others need time to warm up. An infant's temperament influences responses to the caregiving environment. Some visually impaired infants, particularly those with additional special needs, may exhibit irritable and unpredictable behavior which makes responsive caregiving a challenge. It is important to recognize the infant's particular temperamental style and to modify interactions accordingly. Expressions of temperament can be modified by environmental characteristics (Goldsmith et al., 1987; Goldsmith & Campos, 1990). For example, an infant with an unpredictable feeding or sleep schedule may become more predictable through consistent mealtime and bedtime routines. A toddler who needs time to adapt will benefit from short visits to a center-based program with the caregiver before staying at the center for three hours without the caregiver. Early interventionists can assist caregivers in identifying an infant's personality traits and in adapting expectations and caregiving routines as needed. Parent questionnaires have been developed as a systematic means of identifying an infant's temperamental style (Buss & Plomin, 1984; Carey & McDevitt, 1978).

- Special attention may be required to identify and **interpret the visually impaired infant's emotional reactions** and to **provide feedback to the child about the emotions of others.** Emotional responses seem to be partially biologically determined and partially learned (Hyson & Izard, 1985). Sighted infants mirror their caregiver's emotional expressions (Jones & Raag, 1989), and will comfort a peer in distress (Vandell, Wilson & Buchanan, 1980; Vandell & Wilson, 1987). Infants with severe visual impairment have restricted access to the emotional expressions of caregivers or peers. They will not see that other children have similar reactions to specific situations or the mirroring of their emotional expressions by caregivers. These children need specific support to develop an understanding of their own feelings and strategies to express those feelings.

  Considerations: Provide simple verbal descriptions to identify and acknowledge an infant's positive and negative feelings while providing comfort or control as needed. For example, when an infant laughs while playing, say: "You're happy. You like to swing."; or cries because a caregiver leaves, say: "You're sad that mommy had to

go to work. You miss her."; or has a temper tantrum, say: "I know you're angry, but I can't let you hit me." In situations involving other children, adults can comment on another infant's emotional response and assist the visually impaired infant's approach and interaction (e.g., "Mary's crying, she fell down. She's sad. She needs a hug.").

- Toddlers with visual impairment **benefit from supported play experiences with familiar sighted peers**. An infant's interactions with peers will depend on developmental level as well as severity of vision loss. Left on their own in nursery school, toddlers who are blind remain uninvolved with toys and peers (Priesler & Palmer, 1989). Infants, toddlers, and preschoolers who are blind also tend to interact less with peers compared to sighted children of the same age (Kekelis, 1992; Troster & Brambring, 1994). Toddlers and preschoolers with visual impairments use toys more for stereotypic actions such as mouthing, banging, and waving than in ways they are intended (Parsons, 1986). Young children who are blind prefer noise-making objects, household objects, natural objects (e.g., smooth stones), musical toys, and tactile-auditory games (Troster & Brambring,1994). The *Early Development of Social Play* chart provides a framework for developing interventions to encourage peer interactions and social play. See the chapters on *Cognitive Development and Fine Motor Development* for specific suggestions for encouraging the infant's interactions with objects.

  Considerations: **Adult support is needed to provide toys that motivate peer interaction, to provide verbal and physical prompts as needed, and to offer choices for activities that are enjoyed by both infants.** These strategies should provide just enough support to promote interaction with a peer. Care should be taken to avoid being intrusive or directive, or interrupting naturally occurring interactions between toddlers. First, identify a sighted peer who has similar interests (e.g., active and physical play) and likes the toddler with a visual impairment. Then develop a consistent and motivating play routine (e.g., a follow-the-leader game through a simple obstacle course or playing with blocks). Provide repeated opportunities for playing this game together. Over time, the toddlers' familiarity with the play routine and with each other will allow them to develop more complex social play behaviors and friendship. These experiences provide a necessary foundation for the young child with visual impairment to participate in preschool and other settings with sighted peers.

Opportunities for Learning

The following experiences will support an infant's healthy emotional development and development of social interactions:

- A responsive caregiving environment can be created by:
  a) responding to infant signals of discomfort and other needs in ways that the infant can perceive,
  b) developing predictable caregiving routines and interactions that fit the infant's individual characteristics,
  c) providing identifying cues to encourage recognition of familiar caregivers, and
  d) using leave-taking and greeting rituals to assist the infant's understanding of separation and reunion.

- Opportunities for the infant to develop a sense of self and competence can be provided by:
  a) encouraging the infant's active participation in daily activities and completion of simple tasks,
  b) supporting the infant's mobility and exploration,
  c) providing ways for the infant to check in with caregivers when not physically close, and
  d) consistent and supported experiences for facilitating play with sighted peers.

- A caregiver's feeling of competence and self-esteem can be supported by:
  a) emphasizing the endearing qualities of the infant,
  b) identifying positive infant responses to the caregiver,
  c) acknowledging effective strategies that the caregiver uses, and
  d) engaging in activities that both the caregiver and infant enjoy.

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Emotional Development Charts

The emotional development of infants with visual impairments has been examined in terms of two processes. Indicators for these processes are listed in the corresponding charts that follow. The charts can be used to help determine critical skills and behaviors to consider for intervention with individual infants.

For each process, determine the developmental cluster for an infant by identifying the skills and behaviors that an infant has attained. Then use the skills and behaviors within that developmental cluster or at the next developmental cluster as guides when devising an intervention program for the child. (Note: Some infants may have skills and behaviors in more than one cluster in a developmental process.)

Process **Attachment to a Significant Caregiver**

The infant demonstrates an emotional tie through recognition of and communication with significant caregivers.

Process **Sense of Autonomy**

The infant demonstrates interest in performing simple tasks independently.

Emotional Development

Process: Attachment to a Significant Caregiver

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Infant maintains a quiet alert state	Greenspan	Maintenance of a quiet alert state enables infant to attend to environmental stimuli.	Assist infant attention by providing subdued environment and by eliminating overwhelming stimulation. Hypersensitive infants are overstimulated easily and may benefit from swaddling, gentle rocking, careful positioning, and specific handling techniques including firm touch. Once the infant is calm and alert, introduce a particular stimuli, (e.g., music) and observe the infant's reaction to determine the appropriate type, quality, and quantity of stimulation. Hyposensitive infants appear passive and drowsy and require positioning as well as frequent touch and movement input to maintain an alert state. Interpret and respond to infant behaviors as communicative.
	Infant cries, smiles, cuddles and fusses	Ainsworth	Signal behaviors elicit and maintain caregiver attention to infant.	
	Infant anticipates having needs and wants met	Erikson	A predictable and sensitive caregiving environment promotes an infant's sense of trust and safety. An unpredictable and inconsistent caregiving environment fosters fear and mistrust.	Develop predictable caregiving routines. Provide consistent responses that the infant can perceive. Provide information on what is about to happen in ways accessible to the infant (e.g., use a tactile cue to indicate diaper change by tugging at diaper) and give the infant time to prepare for the activity and to respond.
	Infant smiles* at primary caregiver	Ainsworth Greenspan	Indicates recognition and differential responses. Features of the caregiver (i.e., face, voice, smell, and touch) are associated with the pleasures of food and comfort.	Caregivers may need to emphasize certain characteristics (e.g., specific greeting, exaggerated intonation, special scent, move or hold the baby in particular ways) during nurturing routines.
	Infant demonstrates recognition of caregiver's voice	Reynell-Zinkin	Infant responds differentially to familiar and unfamiliar voices.	Use characteristics of caregiver speech, varied pitch, and repetitions.

** An infant who is totally blind will recognize a primary caregiver through nonvisual experiences and characteristics.*

Emotional Development

Process: Attachment to a Significant Caregiver [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 2	Infant attends to caregiver and environment	Greenspan	Shows interest in caregiver behaviors and environmental events.	Position the infant close to family activities and interactions. Engage infant attention to and interest in the environment.
	Infant initiates request for attention	Reynell-Zinkin	Responds to persons and objects through movements and actions (e.g., vocalizes or reaches for parent).	Respond to infant behavior as communicative. Mirror the infant's affect through facial expressions, vocal intonation, and touch as appropriate to enable recognition of different feelings (e.g., tired, happy, sad, excited).
Cluster 3	Infant differentiates between familiar and unfamiliar people	Fraiberg Reynell-Zinkin	Shows stranger anxiety. Approaches strangers with caution and may withdraw and seek caregiver. Shows fear of separation.	Provide "transitional objects" (e.g., a favorite blanket, toy) and a particular adult to support the infant's separation from familiar caregivers. Provide clear leave-taking and greeting routines to assist the infant's understanding that significant caregivers will return. Provide a warm caregiving environment by responding to the infant's need for physical contact and reassurance when separated from a significant caregiver.

Emotional Development
Process: Sense of Autonomy

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 4	Infant moves away from caregiver and checks in periodically	Greenspan Mahler	Maintains contact with a parent across a room, while learning to act independently. Use of distal (beyond physical contact) communication supports the infant's development of self-image.	Develop games that have a predictable sequence of separation, checking in through vocal/auditory means, and culminating in physical contact (e.g., "Where's baby? I'm coming to get you. There you are!"). Provide sound cues to support the blind infant's ability to check in and monitor the whereabouts of the primary caregiver.
Cluster 5	Infant explores environment and wants to complete simple, familiar tasks without assistance	Erikson	Infants who are supported in their exploration and are encouraged to try tasks on their own will develop a positive self-image. On the other hand, those who are prevented from exploring or scolded consistently are likely to be fearful, withdrawn, or aggressive.	Provide opportunities for infant to engage in physical play and exploration, to make choices, and to participate actively in everyday routines, help around the home (e.g., put toys in basket), and to engage in communication. Provide positive verbal and physical feedback on activities. Encourage and support infant's attempts to perform tasks independently. Provide opportunities for the infant to complete small, simple, and familiar tasks, and to experience a sense of accomplishment and success.

Emotional Development

SOURCE	POPULATION	TYPE
Ainsworth	normally sighted infants and infants at risk for disabilities	theory, research, and clinical observation
Erikson	normally sighted infants	theory and clinical observation
Fraiberg	infants who are totally blind or have light perception only	research study
Greenspan	normally sighted infants and infants at risk for disabilities	theory and clinical observation
Mahler	normally sighted infants and infants at risk for disabilities	theory and clinical observation
Reynell-Zinkin	normally sighted, totally blind and infants with visual impairments; includes premature infants and infants with multiple disabilities; age levels derived from Maxfield-Buchholz Scale for children with visual impairment	developmental scale

Social Development Chart

The development of social skills and behaviors in infants with visual impairments has been examined in terms of one process. Indicators for this process are listed in the chart that follows. The chart can be used to help determine critical skills and behaviors to consider for intervention with individual infants.

For this process, determine the developmental cluster for an infant by identifying the skills and behaviors that an infant has attained. Then use the skills and behaviors within that developmental cluster or at the next developmental cluster as guides when devising an intervention program for the child. (Note: Some infants may have skills and behaviors in more than one cluster in a developmental process.)

Process **Social Play**

The infant participates in enjoyable interactions, first with adults and later with peers.

Social Development
Process: Social Play

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Infants participate in social exchanges with caregiver	Dunst Odom	Early caregiver-infant interactions involve mutual gaze, smiling, and vocal turn-taking.	Develop enjoyable early exchanges and social routines to fit the temperament and sensory needs of a visually impaired infant. For example, some blind infants enjoy rhythmic vocal exchanges combined with a gentle movement. Carefully observe the infant's responses to interaction in order to determine particular preference for type, quality, and quantity of stimulation.
Cluster 3	Infants respond to social behaviors of other children	Vandell, Wilson & Buchanan	Sighted infants smile and vocalize in response to social behaviors of peers. They begin to differentiate between adults and children.	Introduce opportunities for infants with visual impairments to become aware of and interact with sighted peers during situations that are natural for and preferred by the family (e.g., gatherings with friends and relatives, community play groups, and day care).
Cluster 4	Infants begin to interact with each other by using toys or objects	Eckerman, Whatley & Kutz	Toys provide the social context for interaction with peers.	Opportunities for peer interactions and for developing friendships become critical as the infant becomes older. Infants with visual impairments benefit from participation in typical environments with sighted peers. Adult support is needed to encourage interactions. Selected toys should provide feedback that the visually impaired infant can perceive and that invite peer interactions. Infants might be placed beside each other for a ride in a rocking boat or take turns going down a small slide. A simple manipulative game might involve dropping blocks into a metal bucket or playing at the water table. An adult should comment on who is doing what, prompt turntaking, invite sharing of toys, and follow the infant's lead in making suggestions for play activities.
Cluster 5	Infants engage in brief simple actions with peers	Mueller & Lucas	Peer interactions include watching, vocalizing, touching, and imitating each other.	
Cluster 6	Infants begin to participate in more complete interactions with each other	Mueller & Brenner Mueller & Rich	Turn-taking and role-sharing is emerging.	

Social Development

SOURCE	POPULATION	TYPE
Dunst	normally sighted infants and infants with disabilities	clinical observation
Eckerman, Whatley, & Kutz	normally sighted infants	research study
Mueller & Brenner	normally sighted infants	research study
Mueller & Lucas	normally sighted infants	research study
Mueller & Rich	normally sighted infants	research study
Odom	normally sighted infants	literature review
Vandell, Wilson, & Buchanan	normally sighted infants	research study

COMMUNICATION DEVELOPMENT

Communication Development

Description

Communication involves the ability to exchange ideas, information, and feelings. Early communication with an infant requires the caregiver to interpret infant behaviors as meaningful and communicative (whether or not this is the infant's intention) and to respond to these behaviors (Dunst, 1978).

Explanation

A visual impairment may restrict an infant's opportunities for social interaction especially before infant behaviors are clearly communicative. The intent of subtle or unconventional behaviors of infants with visual impairment may not be recognized or may be misinterpreted. Before developing words, the infant with visual impairment has limited ways of expressing needs and wants and engaging in communication. Research indicates that attainment of developmental milestones such as first words by infants who are blind does not necessarily differ from sighted peers (Bigelow, 1990; Fraiberg, 1977). However, there is a difference in how the child with visual impairment uses these early words (Dunlea, 1989).

Traditionally, communication interventions have focused on the form and content of language and on building receptive and expressive vocabularies. Recent approaches recognize that the *need to communicate* develops first and is the foundation of language development. Current emphasis is on pragmatics or the social aspects of communication (Linder, 1993). Specifically, the infant's communicative behaviors should be analyzed in terms of communicative intent, functions, and discourse skills in order to determine appropriate interventions.

This chapter will emphasize the influence of social interaction and language input on the communication development of infants who are visually impaired. Interventions will focus on the development of turn-taking and purposeful communication within the context of natural routines.

Communicative Intentions

The development of purposeful communication occurs in the following sequence:

Preintentional communication	The infant exhibits behaviors such as crying, smiling, fussing and other behaviors that are interpreted as communicative.

Beginning of intentional communication	The infant uses preverbal signals and gestures such as pointing and reaching.
Intentional communication	The infant communicates through gestures, vocalizations, and words.

(Bates, Benigni, Bretherton, Camaioni, & Volterra, 1977, 1979)

The processes involved in the development of intentional communication, selected indicators, and suggested interventions are outlined in the chart *Early Communication Development* at the end of this chapter. This information can be used to identify the communication level of an infant with visual impairment and to develop specific interventions to support and expand the infant's communication.

Communicative Functions

Researchers have developed classifications to identify the purpose or function of early communicative behaviors. Infants demonstrate a variety of behaviors to initiate, to maintain, and to respond to interactions. Bruner (1981) has identified the three main categories for early communicative functions in the first two years. Other classifications of early functions (Coggins & Carpenter, 1981; Dore, 1974; Roth & Spekman, 1984) are presented under Bruner's categories.

Behavior regulation

The infant's purpose is to get someone to do or stop doing something.

- Protest, refusal, or rejection
- Request for object
- Request for action

Social interaction

The infant's intent is to get the attention of another.

- Greeting
- Attention seeking
- Request for social routine
- Request for comfort

Joint attention

The infant's purpose is to call attention to an object or event.

- Comment on object
- Comment on action
- Request for information

Communicative Functions During Infancy provides a list of early functions under each category: behavior regulation, social interaction, and joint attention with examples of early intentional communication and suggestions for intervention. First, the purpose or intent of an infant's preverbal and verbal communicative behaviors should be identified; then interventions should be developed to expand the infant's repertoire of communicative functions and to elaborate the infant's communicative behaviors using existing functions.

Communicative Functions During Infancy

FUNCTION Behavior Regulation	CLARIFICATION	BEGINNING INTENTIONAL COMMUNICATION	INTENTIONAL COMMUNICATION	SUGGESTIONS FOR INTERVENTION
Protest, refusal, rejection	Commands parent to stop disliked activity, rejects activity or object	Infant whines and pushes at parent's hand with washcloth	Says "no" and turns head	Acknowledge the infant's communications and provide words for their meaning (e.g., "ooh, don't like getting your face wet").
Request objects	Asks for objects	Infant reaches for cracker on plate	Says "cracker"	Provide opportunities for the infant to indicate requests for favorite objects (e.g., give a small helping of a favorite food and wait for the infant to request another piece). Expand on the infant's words (e.g., "want cracker," "I like crackers").
Request action	Commands parent to do something	Infant puts parent's hand on stereo button	Says "on" while pulling parent's hand to stereo button	Interrupt a favorite activity (e.g., listening to music, being pushed on a swing), wait and interpret the infant's nonverbal behaviors (e.g., fussing) and model or expand verbal request ("music on").

Communicative Functions During Infancy [Continued]

FUNCTION Social Interaction	CLARIFICATION	BEGINNING INTENTIONAL COMMUNICATION	INTENTIONAL COMMUNICATION	SUGGESTIONS FOR INTERVENTION
Greeting	Uses social conventions, i.e. "bye," "hi," "mama"	Infant waves when brother leaves	Waves and says "Bye-bye"	Develop greeting and leave-taking routines.
Attention seeking	Seeks attention to self or aspects of environment	Infant pulls on dad's pant leg	Tugs on dad and says "dada"	Provide opportunities for the infant to initiate getting attention by delaying an anticipated event (e.g., the baby is on the floor by dad's feet. They have a favorite "horsey" game in which the infant gets a ride on dad's legs. Dad waits for the infant to vocalize and responds "oh, you wanna play").
Request for social routine	Asks for caregiver to participate in familiar game	Infant pulls up shirt and pats tummy	Pull up shirt and says "tummy"	Develop familiar social routines with ways for the infant to initiate them (e.g., pulling up shirt to request a "tickle tummy" game, sitting on dad's legs to request "ride horsey" game) and respond to the infant's efforts to initiate them (e.g., "I'm gonna tickle your tummy").
Request for comfort	Seeks comfort from caregiver	Infant reaches toward caregiver while fussing	Reaches toward mother and says "mama"	Respond to signals of distress by holding and comforting the infant. Expand on communicative behaviors (e.g., "you want up").

Communicative Functions During Infancy [Continued]

FUNCTION Joint Attention	CLARIFICATION	BEGINNING INTENTIONAL COMMUNICATION	INTENTIONAL COMMUNICATION	SUGGESTIONS FOR INTERVENTION
Comment on object	Calls attention to aspects of an object	Infant points to ball in toy store, looks at mother	Says "ba" and points to balls	Point out familiar objects that are beyond the infant's reach. When feasible, take the infant over to touch selected objects (e.g., to the basket of balls in the toy store). Expand on the infant's comments (e.g., "Yes, that's a bumpy ball.").
Comment on action	Calls attention to action of object, self, or others	Infant says "uh-oh" when pushes toy off high chair tray	Says "down" as pushes blocks off high chair tray	Describe the infant's actions on objects.
Request for information	Wants to know about an object or event	Infant looks at front door and then at mother	Says "dada, bye-bye?"	Interpret and expand on the infant's communications (e.g., "Daddy went bye-bye. He's at work").

Discourse Skills

An assessment of infant communication should also include an analysis of discourse skills and address the following questions:

- How does the infant attend to the speaker?
- How does the infant participate in turn-taking?
- How does the infant initiate, maintain, or change a topic?
  (Andersen, Dunlea, & Kekelis, 1984; Linder, 1993).

Visually-guided behaviors encourage caregiver-infant interactions and support the infant's participation in early turn-taking routines. Initially, sighted infants use gaze, eye contact, gestures, and vocalizations to initiate topics that are physically present. As their cognitive skills develop, they begin to introduce topics that are not physically present. By the end of the second year, infants participate in short conversations with a few turns (Linder, 1993).

A severe visual impairment may inhibit the natural development of turn-taking routines and may restrict an infant's natural access to topics that are physically present. For an infant who is blind, making requests and comments about topics that are present but not perceived is similar to a sighted infant referring to topics that are not physically present. Therefore it cannot be assumed that achievement of similar communicative functions and discourse skills indicate comparable developmental levels in blind and sighted infants (Urwin, 1983).

Intervention Concerns

Communication develops through reciprocal interaction or give and take between infant and caregiver within meaningful and motivating activities. However, an infant's vision loss makes it more difficult for parents to establish joint attention, interpret communicative intent, and expand on a mutual topic with the infant (Kekelis & Andersen, 1984). Consequently, an infant with a severe visual impairment may need specific supports to participate in early exchanges and a caregiver may need to develop alternative strategies for encouraging interaction. The following considerations support the communication development of infants with visual impairment.

- The **potential meaning of early behaviors should be recognized** in order to develop meaningful interactions with infants who are visually impaired. Preverbal communication usually depends on eye contact, gaze, and pointing to get the message across. Consequently, infants with visual impairment may have a limited repertoire of behaviors for initiating and maintaining early interactions (Burlingham, 1964; Fraiberg, 1977; Rogers & Pulchalski, 1984; Urwin, 1983). Furthermore, early behaviors may not be easily recognized or understood. Hand movements of infants who are blind may be significant preverbal behaviors, yet these behaviors may be difficult to interpret (Fraiberg, 1974, 1977). The quieting behavior or listening stance of an infant who is totally blind may be interpreted

incorrectly as disinterest in what is going on (Burlingham, 1964). Recognizing the potential communication intent of early behaviors of infants with visual impairment and other disabilities may be even more of a challenge because the behaviors may be idiosyncratic and context-bound. Caregivers need support in observing, interpreting, and responding to an infant's early behaviors especially when these behaviors are subtle or atypical (Chen & Haney, 1995).

Considerations: During the first months, early behaviors such as crying, smiling, and fussing should be interpreted as meaningful even though the infant is not using them intentionally. By about 9 months of age, most infants use a variety of intentional preverbal communicative behaviors to express needs and wants. An infant with visual impairment may use unconventional preverbal communicative behaviors (e.g., quieting when interested in an activity). Specific attention should be given to these preverbal behaviors, and efforts should be made to interpret their meaning within the context of the situation and knowledge of the individual infant in order to respond to them appropriately.

- Before infants can learn ways to participate in verbal exchanges, they need to participate in **preverbal turn-taking routines**. Parents of infants with visual impairment develop specific strategies for engaging their infants in vocal exchanges and interactive routines (Chen, 1996; Urwin, 1978). Similarly, parents of infants with visual impairment and multiple disabilities create mutually-enjoyable turn-taking games to engage their infants' attention and participation (Chen & Haney, 1995). These predictable social interactions may facilitate language development (Fraiberg, 1977; Rogow, 1982; Rowland, 1983, 1984; Urwin, 1978). First words emerge from mutually enjoyable routines in which the infant has some control (Urwin, 1983).

  Considerations: Individualized routines are needed to establish joint attention and engage the infant in turn-taking. Exchanges can be developed by using vocalizations that are within the infant's repertoire or sounds combined with actions and/or touch that elicit a pleasurable infant response. Initial routines may become ritualized with frequent use and should be expanded to promote infant learning.

- **Preverbal turn-taking routines should be expanded** to promote communication development of infants with visual impairment. Rowland (1984) found that although mothers spoke frequently to their blind infants with developmental delays, it was not in response to infant vocalization. When infants vocalized, these mothers tended to respond by touching or making sounds to their infants. After their mothers vocalized, these infants were more likely to smile than vocalize. In contrast, Urwin (1978) reported that a mother-infant pair maintained interaction through sustained and extended ritualized vocal imitations. However, this mother also encouraged the infant's use of words.

  Considerations: Vocalizing in response to an infant's vocalization can establish turn taking, early imitation, and the beginning of conversation. Infants imitate sounds that

are within their own repertoire. Caregivers can encourage vocal imitation and turn-taking by responding to infant vocalization with an exact imitation and then pausing for the infant to vocalize. Once a vocal imitation game is established, the caregiver can alter the vocalization by changing the number of syllables or intonation pattern to shape a different sound. When developmentally appropriate, speaking in response to an infant's vocalization will provide a model of the next step in communication development.

- Efforts should be made to provide a **natural yet meaningful language learning environment** for infants who are visually impaired. Research has found that maternal language input to toddlers and preschoolers with visual impairment varies from language input to sighted peers. Mothers of infants who are visually impaired tend to talk more about child-related topics and less about object or environment-related topics than mothers of sighted infants (Andersen, Dunlea & Kekelis, 1993; Kekelis & Andersen, 1984; Urwin, 1978). This type of language input may result in children's frequent use of specific labels and self-centered topics. Infants who are blind tend to use words to refer to specific objects or events rather than as classes (Dunlea, 1989). Researchers have suggested these variations may reflect cognitive differences (Andersen et al., 1984; Bigelow, 1990). Warren (1994) suggests that the language environment is the main contributor to observed differences in language used by children with visual impairment.

  Considerations: Some interventionists have recommended ongoing verbal description of surrounding situations and activities to provide the infant who is visually impaired with access to information about the environment. However, this strategy is not developmentally appropriate or meaningful for a very young child. It is extremely important to comment on aspects of the environment and situations that are most salient for the infant, such as, what made a sound, what is happening right now, what will happen next, and what the options are for various activities (Chen, 1993). In addition, the infant will need to have direct experience with objects and activities in order to develop an understanding of the words. See selected resources (Kekelis & Chernus-Mansfield, 1984; Kekelis, Chernus-Mansfield, & Hayashi, 1985) for guidelines on promoting the language development of toddlers and preschoolers who are visually impaired.

- Infants with visual impairment benefit from **systematic and contingent responses** to their communication efforts that are developmentally appropriate. Dote-Kwan (1995) found that maternal responsiveness was positively related to the development of toddlers who are legally blind with no other disabilities. Maternal behaviors included responding to the infant's request for help or for an object, paraphrasing or repeating the infant's communications, adding new information to the infant's utterances, and pacing the rate of speech and length of pauses to promote turn-taking in vocal interactions.

  Considerations: *Progressively matched turn-taking* (MacDonald & Gilette, 1986) provides an intervention strategy for turn-taking by imitating what the infant does and

adding a bit more information. This way, an infant learns from a model that is both developmentally and individually appropriate.

- Interventions to support an infant's communication requires an **analysis of the communication intent and function of** a toddler's **nonverbal** (e.g., facial expressions, body movements, gestures, vocalizations) **and early verbal behaviors** (single and multiword utterances). In addition, it is important to determine the communicative function of echolalia used by a visually impaired infant. Echolalia is the immediate or delayed repetition of a single word or multi-word utterance spoken by another. Research with nondisabled toddlers and young children with disabilities suggest that imitation may be developmentally appropriate, or it may serve as the infant's turn in the conversation (MacDonald & Gillette, 1986). Studies of young children with autism and those with visual impairment suggest that echolalia may support a child's participation in a conversation and provide an opportunity to process what someone has said (Prizant, 1987; Prizant & Duchan, 1981).

  Considerations: Young children with severe disabilities use communication mainly for behavior regulation purposes and have limited use of joint attention functions (Wetherby, Yonclas, & Bryan, 1989). Children's expansion of communicative functions is promoted by an ability to share interests with another person and to refer to objects that are out of reach (McLean, McLean, Brady, & Etter, 1991). Language allows the child who is blind to request information and to comment on topics that are out of reach and beyond the here and now (Urwin, 1983). Toddlers with visual impairment produce many requests for objects, actions, and social rituals but few comments on objects, actions, or requests for information. Preschoolers who are blind, particularly those with additional disabilities, may not acquire a variety of communicative functions without specific interventions (Evans & Johnson, 1988).

Opportunities for Learning

An infant's communication skills can be supported and developed by providing specific experiences.

- Focus on early communication by:
  a) using contextual cues and familiarity with the infant to interpret and respond to preintentional and preverbal behaviors,
  b) developing turn-taking routines composed of sounds, actions, and words which fit the infant's developmental level,
  c) building on the communicative intent and expanding the functions of infant's communicative behaviors, and
  d) providing natural consequences so that the infant recognizes the powerful effects of communicative behaviors during everyday activities.

- Develop a meaningful language environment by:
  a) supporting the infant's active participation in everyday activities,
  b) providing comprehensible language input about the infant's actions and feelings as well as about the social and physical context,
  c) encouraging extended infant turns in conversations about meaningful topics, and
  d) providing opportunities for toddlers who are visually impaired to interact with sighted peers during play, story time, and other situations that motivate conversation.

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Communication Development Charts

The development of communication behaviors in visually impaired infants has been examined in terms of three processes. Indicators for these processes are listed in the corresponding charts that follow. The charts can be used to help determine critical skills and behaviors to consider for intervention with individual infants.

For each process, determine the developmental cluster for an infant by identifying the skills and behaviors that an infant has attained. Then use the skills and behaviors within that developmental cluster or at the next developmental interval as guides when devising an intervention program for the child. (Note: Some infants may have skills and behaviors in more than one cluster in a developmental process.)

Process **Preintentional Communication**

The infant exhibits crying, fussing, smiling, and other behaviors.

Process **Beginning Intentional Communication**

The infant uses preverbal signals and gestures (such as reaching).

Process **Intentional Communication**

The infant communicates through gestures, vocalizations, and words.

Communication Development

Process: Preintentional Communication

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Differentiated cries	Oregon	Has different cries (e.g., for hunger, fatigue, wet).	Respond to infant cries, vocalizations, and other behaviors as communicative. Identify and interpret them within the context of the situation.
	Orientation towards sound source	Reynell-Zinkin	Moves head and/or body towards sound source.	If response to sounds is inconsistent, the infant's hearing must be evaluated.
	Selective response to sound	Reynell-Zinkin	Differential listening. May ignore certain sounds and attend to others.	Some infants may be hypersensitive to and irritated by certain sounds (e.g., sudden and loud). When possible, control the auditory environment. When the infant is older point out the auditory source (e.g., the blender).
	Vocalizes two different vowel sounds	Bayley 2 REEL	Produces at least two distinct vowel sounds.	Use characteristics of caregiver speech to attract and maintain the baby's attention including higher and more varied pitch and repetitions.
Cluster 2	Vocalizes three different vowel sounds	Reynell-Zinkin	Produces at least three distinct vowel sounds.	Repeat infant sounds and use caregiver speech.
	Imitates vocalization	Bayley 2 Oregon REEL	Imitates at least one sound that is within own repertoire.	Imitate the infant's vocalizations and develop turn-taking games (e.g., "peek-a-boo,", "I'm coming to get you" and vocal turn-taking games).
Cluster 3	Cooperates in game	Bayley 2 REEL	Demonstrates familiarity with early game (e.g., pat-a-cake).	Elaborate vocal turn-taking games by varying intonation and number of syllable repetitions. Add a tactile and/or movement component to the game that is in sync with the sounds (e.g., pat the infant's back, bounce, dance or rock together).
	Repeats vowel consonant combination	Bayley 2 Reynell-Zinkin	Produces combination (e.g., da-da, ma-ma, ba-ba, a-ga, a-ga).	Initiate and expand on infant vocalizations.
	Recognizes familiar sounds	Reynell-Zinkin	Demonstrates selective responses to sounds (e.g., reaches out when hears caregiver's voice).	Use exaggerated intonation when greeting the baby. Pause and watch for signs of discrimination and anticipation.
	Recognizes familiar words or phrases	Bayley 2 REEL Reynell-Zinkin	Reacts to specific words (e.g., alerting response, facial expression, reaching out, imitation).	Use a slower rate of speech than normal. Talk about the here and now. Label and comment on familiar objects and activities.

Communication Development

Process: Beginning Intentional Communication

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 4	Uses gesture to make wants known	Bayley 2 Oregon REEL	Uses gestures (e.g., reaching for, pointing at, pushing away objects, shakes head for "no").	Identify the communicative functions of the infant's behaviors, gestures, and sounds. For example, the infant may pull or arch away from a disliked food to indicate refusal. Translate these communications into words and respond to infant's intent.
	Responds appropriately to familiar spoken requests	Bayley 2 REEL Reynell-Zinkin	Demonstrates appropriate action to familiar verbal requests (e.g., "bye-bye," "pat-a-cake," "give daddy a kiss").	Assist the infant with visual impairment to perceive and produce useful gestures by providing necessary physical prompts (e.g., to wave bye-bye).
	Jabbers expressively	Bayley 2 REEL Reynell-Zinkin	Produces conversation-like intonations.	Provide opportunities for infant to respond to specific requests through familiar games (e.g., "give mommy a kiss," "touch your nose," "come get daddy").
Cluster 5	Imitates word	Bayley 2	Approximates at least one word immediately after model (e.g., mama, dada, up, all gone, uh-oh).	Use caregiver speech to comment on the infant's actions and the social and physical context. Pause and encourage infant to take a turn.

Communication Development

Process: Intentional Communication

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 5	Anticipates familiar routines in response to requests	Oregon	Goes to high chair when hears "Let's eat."	Develop predictable routines for familiar activities (e.g., say "Let's eat" and assist infant to go to high chair).
	Uses two different words appropriately	Bayley 2 Fraiberg Reynell-Zinkin Westby	Spontaneous and appropriate use of words elicited by objects or situation. Words may be context dependent.	Delay a response or interrupt a favorite activity to motivate the infant to make a request or continue the activity.
Cluster 6	Uses words to make wants known	Bayley 2 Fraiberg Oregon	Uses at least one word to make request, e.g., "up," "down," "more," "no," "bottle."	Expand on the infant's communications by adding a word to the infant's gestures, vocalizations or utterance or new information to the child's topic (e.g., if the infant lifts arms, respond "up." If the infant says "ball," respond "big ball," and if the infant says "big ball" add "big bumpy ball"). Respond to the infant's utterance and ask a question to engage the infant in another conversational turn (e.g., "Yes, that's a big ball. Wanna play?").
	Combines word and gesture	Bayley 2 REEL	Spontaneous and expressive use of gesture and word (e.g., "up" and lift arms over head).	Respond to infant's gestures. Use gestures with words as appropriate (e.g., "bye-bye," "come here").
Cluster 7	Says eight different words	Bayley 2 REEL Reynell-Zinkin	Spontaneous and appropriate use of words elicited by context.	Provide multiple examples of selected classes of words (e.g., provide choices by naming and offering a choice of different juices in the refrigerator, various toys in the environment.)
	Uses a two-word utterance	Bayley 2 Fraiberg REEL VIIRC	Each word represents a different concept (e.g., "mommy bye-bye").	Provide opportunities for telling stories and reading books. Develop experience stories with relevant objects or souvenirs to talk about a past activity or plan an upcoming event.
	Refers to objects and persons not present	Westby	For example, "daddy work" for "Daddy is at work" or "airplane" after a trip.	Engage the toddler in conversation about ongoing activities, past events, and activities planned for the near future.
	Uses a three-word sentence	Bayley 2 REEL	Sentence does not have to be grammatically correct.	Respond to infant's comment and model correct sentence structure.
Cluster 8	Makes a contingent utterance	Bayley 2	Utterance must add new information to what was said previously.	Respond to toddler's speech with contingent responses (e.g., "Yes, that's a doggy. Grandma has a doggy").

Communication Development

SOURCE	POPULATION	TYPE
Bayley 2	normally sighted infants	standardized development scale
Fraiberg	infants who are totally blind or have some light perception, no other disabilities	research and clinical observation
Oregon	infants who are visually impaired or totally blind	literature review, field test for content validity
REEL	normally sighted infants	standardized development scale
Reynell-Zinkin	infants who are normally sighted, visually impaired or totally blind; includes premature infants and infants with multiple disabilities; age levels derived from Maxfield-Buchholz Scale for children with visual impairment	standardized developmental scale
VIIRC	infants who are visually impaired or totally blind; includes premature infants and infants with multiple disabilities	research study
Westby	normally sighted infants and infants with disabilities	literature review and clinical observation

COGNITIVE DEVELOPMENT

Cognitive Development

Description

This cognitive development section investigates emerging mental processes used to understand and interact in the world.

Explanation

Infants with visual impairment must perform mental operations based upon limited perceptual input. This limited input, in turn, provides children with different and often, less comprehensive information about the environment and about the results of their actions upon it. Yet infants with severe vision loss can learn about the construction of their environment, the properties of objects in it, and how to interact effectively within that framework.

Aspects of cognitive development that will be examined in this chapter are as follows:

Attention	The infant *concentrates* on a particular mental or perceptual event.
Memory	The infant *retains* and *recalls* past experience.
Properties of Objects	The infant understands *physical characteristics* of objects such as size, shape, mass, texture, and part/whole relationships.
Causal Relations	The infant *recognizes a relationship* between a condition and a specific effect.
Conceptual Understanding	The infant *forms generalizations* about objects and events.
Spatial Relationships	The infant understands *the position* of elements in space and how those positions are related.
Problem Solving	The infant *intentionally acts upon objects* in order to achieve desired effects.

The development of thought processes in children from birth to two years has been characterized by Jean Piaget (1952) as the sensorimotor period. During this period, cognitive growth is manifested through the refined understanding of sensory perceptions and an increase in the volitional component and complexity of available motor activities. Infants learn about their environment through active exploration involving looking, mouthing, touching, banging, manipulating, and moving (Chen, 1993).

According to Piaget (1952), the newborn infant possesses simple reflexive responses and performs uncoordinated motor movements. As the infant matures, simple motor actions related to self that produce satisfying results are repeated. From these repetitions, the infant learns to perform simple actions at will. These form the basis for intentional actions related to the self that combine simple action patterns (e.g., bringing the hand to mouth to suck combines waving the hand and sucking.).The infant also gradually becomes aware of the environment and seeks to maintain interesting changes in it that are initially produced by accidental actions. At first, through trial and error, the infant tries to reproduce interesting environmental events and eventually learns to intentionally repeat actions that produce satisfying results (e.g., batting a toy on a mobile). More complex behavior patterns emerge, and the infant learns to anticipate the results of simple intentional actions.

The very young infant is not aware of objects that are outside immediate perceptual experience. The understanding that objects still exist when not directly perceived (object permanence) is a major achievement in the sensorimotor period according to Piaget (1952). With increasing maturity, the infant begins to vary movements, experimenting to see the effects of these variations. The infant also learns new ways to achieve a goal (e.g., pulling a toy to self using an attached string). Finally, at the end of the sensorimotor period, the infant learns to think about how to perform an action to achieve a desired result, arriving at the solution of a simple problem mentally rather than experimenting through trial and error (Pulaski, 1971).

Many aspects of Piaget's theory about the development of cognition places emphasis on the role of vision to provide continuous input about environmental events (Warren, 1994). Piaget also emphasizes active learning by the infant. To support developing cognitive functions in infants with visual impairment, the early interventionist must ensure that:

- infants have ample opportunities to act upon their environment,
- the learning environment provides stimulation and feedback that is readily discernible using available sensory capabilities, and
- feedback from intentional and non-intentional actions motivates infants to continue to explore.

Warren (1994) has stressed that there is a wide range of individual differences in the cognitive development of the visually impaired population. Any degree of vision early in life, even if it

is lost later, is likely to foster cognitive growth (Fraiberg, 1977). The importance of promoting cognitive skills early in life is crucial for infants who are totally blind and for those with low vision. While infants with visual impairment can develop functional mental processes, "circumstances can conspire to delay the cognitive development of infants with visual impairment" (Warren, 1994, p.79). **It is the optimization of these "circumstances" that must be addressed by effective intervention programs.**

Intervention Concerns

Perceptual input from tactile and auditory cues provides different information about the environment than visual input and may result in different processing methods by individuals with visual impairment (Millar, 1988). Some infants with visual impairment may not form specific concepts or develop effective processing skills in learning about their surroundings. Perceptual information from touch and sound may not provide adequate information about space for infants with visual impairment at very early ages (Schwartz, 1984). Cognitive development is intimately tied to the acquisition of fine motor and gross motor skills needed for interaction with the environment. Without an adequate motor base, the development of cognitive skills can be hampered. Specific problems in object exploration and use are addressed in the fine motor development section. Some general considerations affecting overall cognitive development will be mentioned here.

- It is critical that **caregivers learn to interpret reactions** of their infants with visual impairment so that their guidance is appropriate (Freeman, Goetz, Richards, Groenveld, Blockberger, Jan, & Sykanda, 1989).

  Considerations: Infants with visual impairment often become quiet when paying attention to environmental stimuli. This can be interpreted as passivity or boredom if not "read" correctly by caregivers. There can also be an increase in activity level when excited as well as a social smile. The lack of usual smiling behaviors and eye contact can be disheartening to some parents. They must be taught that their children may relax, become more quietly attentive, or become more aroused as alternative responses. Fraiberg (1977) also reports a subtle "hand language" for totally blind infants where the hands make small, fleeting anticipatory movements. It is important to allow the infant sufficient time to respond, especially those with multiple disabilities.

- Infants with visual impairment should **not be left alone for long periods** of time, nor should they be left to listen for long periods of time to the sounds of a radio or record player without feedback from the environment based upon their actions.

  Considerations: While infants with visual impairment can be soothed by listening to gentle or repetitive songs or sounds, it is not advised that this practice be employed for lengthy time periods (i.e., more than 15 minutes) without additional stimulation.

It is necessary to find a method to soothe distressed babies, and this is one method. Unfortunately, the infant will not be participating actively with the world at this time. Once the soothing is accomplished, the infant becomes a passive recipient. At this time, the child is not learning. Toys inviting interaction are critical for children with visual impairment, and caregiver interaction may be more critical for this population than with sighted infants (Freeman et al., 1989).

- In order for infants with visual impairment to learn about their environment, they must learn to attend to significant features in it. Infants must be provided with opportunities to explore, but they may also **require more guidance to single out features** within their environment for more intensive investigation.

  Considerations: Without sufficient visual feedback to maintain attention, infants may not be motivated to examine and perform actions with objects in their environment. This can subsequently limit their developing cognitive processes. Caregivers play a critical role in creating an environment that includes motivating materials, but they must also actively draw the attention of their infants to critical environmental features and operations at appropriate developmental stages. Since infants with visual impairment cannot see actions in order to imitate them, their attention must be drawn to significant features or activities through tactile contact as well as through verbal explanation and encouragement. This takes time and planning and can be accomplished during daily routines such as feeding, dressing, bathing, and interactive play.

- It is very important that children with visual impairment receive sensory input, but this input must not be so overwhelming that children cannot make sense of it or must shut down from overstimulation. Care must be taken to **provide a level of stimulation appropriate to specific situations.** This can be related to the infant's arousal level and the infant's ability to absorb and make sense of incoming stimuli. On the other hand, infants must learn to focus on relevant perceptual cues and filter out extraneous ones in the usual routines of daily life. Exposure to a variety of stimulus levels at appropriate times is recommended, but excessive overstimulation should be avoided. This is particularly important for children with cortical visual impairment since input must be simplified and controlled to resonate with the infant's ability to process and integrate information (Groenveld, Jan, & Leader, 1990).

  Considerations: Nielsen (1991) has placed infants in a special environment called the Little Room (30 x 60 x 60 centimeters), a microenvironment in which outside noise is muffled, objects for exploration are placed within reach and in a constant location, and echoes from infant-generated movements and vocalizations are considered clearly perceivable. Infants performed a greater number of more complex activities with objects in the Little Room than in a control environment replicating the room without walls and ceiling. Nielsen indicates that further research is needed to determine whether certain conditions are necessary to enable infants to transfer skills

from one environment (i.e., the Little Room) to another. This method has merit in serving to focus children's attention to attributes in near space, reducing distractions, and heightening sensory feedback. As mentioned earlier, infants must learn to operate in usual daily environments in order to optimize functioning. Every effort must be made to transfer skills and behaviors learned in a training environment to usual life situations and to eventually wean the infant from the training environment. It should also be remembered that cognitive development, fine motor development, and gross motor development are naturally fostered within a social context. Infants can be guided by caregivers to attend to critical features and operations with objects during daily routines in quiet, consistent environments. Effort should be made to expand infants' skills to various environmental contexts as appropriate. In this way, learning is promoted within a social framework.

- As with any children, infants with visual impairment require **repetition and consistency** in order to retain and recall information about their surroundings. Without visual input, consistent placement of items and repetition of routines become even more critical.

  Considerations: Try to maintain routines with infants who are visually impaired and be certain to leave familiar objects, (i.e., toys, cups, and hair brushes) in predictable places so that the child can learn their location. Once object location is learned, and depending upon the infant's developmental level, it can be repositioned. The infant can help move the object and then find it at its new location.

- **Object permanence** for infants with visual impairment has received much attention in the research literature. The fact that an object exists when it cannot be directly perceived frees infants from the need for immediate sensory information. Even when they cannot see the object or feel it or hear it, they know that it is there. A great deal of variation has been shown for the attainment of this concept by infants with severe visual loss (Warren, 1994).

  Considerations: Encouraging infants to explore objects in near space, promoting strong affective bonds with caregivers, experience in different body positions, and guidance in reaching and searching for objects may promote this skill, especially for infants who are totally blind (Als, Tronick, & Brazelton, 1980; Fraiberg, 1977; Nielsen, 1991; Schwartz, 1984)

- Spatial concepts and understanding positions in space have been found to be problematic for older visually impaired children (Bigelow, 1991; Cratty & Sams, 1968; Hartlage, 1969; Kephart, Kephart, & Schwarz, 1974). Schwartz (1984) postulates that infants with visual impairment may limit their search strategies when they focus on object manipulation skills, (i.e., they explore properties of objects rather than search for objects in space). **Infants must be encouraged to search and locate objects as well as manipulate them in meaningful ways.**

Considerations: For infants who are totally blind, this begins with locating objects touching the body. An infant who touches an object in contact with the body can be encouraged to feel the object as it is slightly moved away and held stationary. Infants who are totally blind reach for objects in tactual contact before they will reach for continuous, sound-making objects that they do not touch. They will also reach for objects that were in tactual contact and then removed before they will reach for sound-making objects whose sound has stopped (Bigelow, 1986). Reaching for objects based upon a combination of tactual and auditory cues is also recommended. Fixed objects can be positioned in particular locations, and infants can be encouraged to feel the objects whenever they are there (e.g., a familiar teddy bear is always in the same place on the changing table, a familiar, safe cloth rattle toy is always in the same place in the crib). Through repeated exposure, the infants will learn to search for favored objects in their set locations.

- Within arm's reach is considered *near space* and beyond arm's reach is considered *far space,* according to Warren (1994). Infants with visual impairment often limit their exploration to near space, the space within arm's reach. **Exploration of near space must be encouraged along with exploration of space beyond arm's reach** which often goes hand-in-hand with crawling, creeping, or walking.

  Considerations: Infants can search for food on their tray or table top once they know where the expected location or locations can be (start with one location at first). They can also learn to search for their favorite toy in an expected location, then in two locations, and so on. In addition to encouraging manual search for objects in near space, encourage infants with visual impairment to search their surroundings beyond arm's reach as soon as self-initiated mobility emerges. Be sure that furniture is kept in familiar locations so that the infant can use the furniture as landmarks. Arranging the infant's surroundings so that it is safe for independent exploration will allow the child to move freely and without fear. The infant can be motivated to locate a favored toy or move from one portion of a room to another to find a caregiver. Use the same route at first to facilitate learning. Expanding a child's area of search should be systematic to foster route learning as well as learning about the position of objects in space.

- Space, for infants who are blind, is "organized primarily in relation to the self rather than as a system with an external structure that does not depend on the location or orientation of the infant." (Warren, 1994, p.106). According to Warren (1994), spatial concepts first develop in relation to the body's location (egocentrically organized space) and later in relation to external locations (allocentrically organized space). Children transition from the use of concepts of space in relation to the body's location to externally organized concepts of space in later infancy. **The development of externally organized spatial concepts helps infants use external spatial cues to guide performance**. This can be delayed in infants

who are blind and appears to be facilitated by some degree of vision or early visual experience.

Considerations: The development of allocentrically organized spatial concepts depend upon a firm foundation in concepts related to the body such as body parts, body position in space, and the relationship of objects to the body. Infants can be encouraged to locate and identify body parts, gain experiences with their bodies in various positions in space, and experience the position of external objects in relation to their bodies. Bringing a hand, arm, or leg toward external objects rather than bringing objects to the body helps give the infant an understanding of the world within reach. The hand-arm system can provide sufficient information for near space tasks that often require the use of egocentrically organized spatial concepts but may not be sufficient for far space tasks that require the use of allocentrically organized spatial concepts. Infants with visual impairment must rely upon memory as well as the use of sound, touch, and movement to learn about far space. Allowing the infant to explore home and learning environments with stable, familiar features can help facilitate the development of allocentrically organized spatial concepts for infants with little or no vision. Once older infants have an understanding of where fixed objects are in a familiar room, they can learn through independent exploration and interactive games to purposefully go from one familiar landmark to another (e.g., an infant sitting in the toy corner learns to move directly towards a favored sofa).

- It has been found that **certain concepts need to be specifically taught** to children with visual impairment. They are not learned through normal daily interactions with their environment. These include concepts about spatial locations (e.g., up, down, in, on), objects in the environment not readily encountered tactually, but heard often (e.g., vacuum cleaner, air conditioner) and more complex concepts critical for the infant's understanding of the environment such as the concept of a floor as a continuous surface (Hall, 1982; Hill, 1981; Sonksen, Levitt, & Kitsinger, 1984).

  Considerations: Present the concepts in the context of planned experiences and as they arise during daily routines. Many concepts arise with emerging language, but all require a firm experiential base. It is important to involve infants in experiences that promote a complete understanding of the organization of the world around them. For example, children with visual impairment must learn that cereal is poured from a box and the cereal box is stored in a cupboard. Older children will learn that the cereal box is purchased in a grocery store. The spoon to eat the cereal comes from the silverware drawer. The spoon is washed in the sink when eating is completed and returned to the silverware drawer. Milk for the cereal comes from a carton and the carton comes from the refrigerator. During daily routines, landmarks along a usual travel route can be singled out for infants with visual impairment, and the infants can be told where they are going (Langham, 1995). For example, when moving from the changing table to the kitchen, an older infant can be told: "It's time

to eat. Let's find your high chair. We're moving through the door. Now let's go down the hall. Feel the wall. Oh, the wall is gone, it's time to turn. And here's your chair." It is important to keep these descriptions simple so that the child is not overwhelmed by the verbal input. The infant can occasionally be encouraged to touch the door frame and to follow the wall with the back of the hand along the way. An interesting piece of textured cloth can be hung along the wall for the infant to feel along the way, or the textured cloth could be positioned at the end of the wall to signal the end of the wall and the need to turn toward the high chair.

Opportunities for Learning

Cognitive skills can be promoted by the following opportunities for learning:

- Supporting the development of a strong affective bond between infant and caregivers
- Providing appropriate levels of environmental stimulation depending upon external circumstances and the internal state of the infant
- Guiding the infant to investigate object features and actions with objects, starting with the child's current level of cognitive functioning and moving to a slightly higher level
- Encouraging the infant to examine and search near space and far space in meaningful ways
- Promoting the conceptual understanding built upon a firm experiential base including specific training for concepts not learned casually by infants with visual impairment
- Promoting a more complete understanding of the organization of the environment by providing direct experiences that demonstrate where functional objects originate from and where they are returned during the course of daily routines as well as experience identifying major fixed objects along usual travel routes in familiar areas

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Cognitive Development Charts

The development of cognitive skills and behaviors in visually impaired infants has been examined in terms of three processes. Indicators for these processes are listed in the corresponding charts that follow. The charts can be used to help determine critical skills and behaviors to consider for intervention with individual infants.

For each process, determine the developmental cluster for an infant by identifying the skills and behaviors that an infant has attained. Then use the skills and behaviors within that developmental cluster or at the next developmental cluster as guides when devising an intervention program for the child. (Note: Some infants may have skills and behaviors in more than one cluster in a developmental process.)

Process **Conceptual Understanding**

The infant understands properties of objects.

Process **Spatial Relations**

The infants relates his/her body to objects in space.

Process **Problem Solving**

The infant plans actions with objects.

Cognitive Development

Process: Conceptual Understanding

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Discriminates between two sound toys	Bayley 2	After habituating to one sound toy, alerts to a second toy which makes a different sound	Encourage play with soft-textured, sound toys with young infant.
	Recognizes primary caregiver	Bayley 1&2 Haith Reynell-Zinken	Infant makes postural adjustments or alters expression when held by stranger versus primary caregiver.	Encourage caregiver to use consistent and predictable handling techniques and to provide sensory cues (e.g., voice, touch, smell) to promote recognition.
	Plays with rattle	Bayley 1&2 Norris et al.	When infant has rattle in hand, child attends to or plays with rattle in any way: looking, touching, shaking, holding.	Encourage infant to play with toys that are interesting to touch, hear, smell, and/or see. The toys should be small enough for the infant to hold.
	Responds differentially to different textures and temperatures	Carolina	Infant makes any type of response when objects of various textures or temperatures are rubbed over child's skin (hands, face, arms, legs) for a brief period.	Exposure to various tactile experiences at early ages is important for infants with visual impairment. This can be accomplished as part of daily routines (e.g., rubbing lotion during diaper changes, feeling textures on skin during bath time, feeling different textures on clothing items, stroking the baby's arm or stomach).
Cluster 2	Uses object to bang surface *(also in Fine Motor Development Section)*	Bayley 1&2	Infant purposely bangs in play, using an object to bang the table or other surface.	Assist infant in performing these actions with hands or objects since infant may not see well enough to imitate actions of others. Provide objects and surfaces that motivate the banging action and provide auditory feedback (e.g., xylophone or hammer tapped on wood surface or metal pan).

Cognitive Development

Process: Conceptual Understanding [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTION FOR INTERVENTION
Cluster 2	Shows preference in play materials	Norris et al.	Infant frequently searches for particular toys and plays with them to the exclusion of others. Must be a positive interest in play and not a fixation on one item or lack of interest in other things.	Be certain the infant with visual impairment learns about a variety of toys, materials, textures. Occasionally rotate toys to encourage interest in variety along with keeping a few favorite toys available. Some infants may show interest in few or no play material. Gradually introduce new material using carefully selected scaffolding techniques to encourage expansion of materials and exploration.
	Shakes sound toy in imitation and listens to sound	Bayley 1&2	After demonstration by adult, infant shakes sound toy and listens intently: rings bell, shakes rattle, etc.	The caregiver can imitate the infant's action to encourage the development of interactive play. To imitate the actions of another person, the infant may require some form of tactual contact or physical guidance, especially if the infant is totally blind. Prompts should be reduced as the infant becomes familiar with the toys and actions involved. This type of activity can be encouraged during interactive play time.
Cluster 3	Explores different textures *(also in Fine Motor Development section)*	Norris et al. Reynell-Zinken	Infant is interested in toys or objects of different textures such as stuffed animals, metallic toys, sandpaper, smooth toys, prickly toys, etc.	Provide opportunities and encourage infant to play with objects of different textures. If any resistance occurs, present textures on most receptive body parts, gradually working towards acceptance by the hands. Be certain to encourage the infant to actively explore and differentiate textures. Encouragement to explore textures during daily routine is recommended (e.g., finger feeding with different foods; wearing and exploring clothing made with corduroy, Angora, quilted material).

Cognitive Development
Process: Spatial Relations

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Turns head to sound source	Bayley 1&2 Norris et al.	When sound toy is shaken to left or right of each ear, infant turns in direction of sound source even though infant cannot see toy.	Practice during interactive play with soft-sounding toys.
Cluster 2	Recovers toy in contact with body	Bayley 1 Friedman & Chen Norris et al.	When object of interest that was dropped or taken away is placed in contact with infant's body, infant recovers object.	To promote this behavior, move infant's hand to toys that are dropped or gently taken away and placed in contact with the infant's body. Move hands to the object rather than object to infant's hands. Move the object close by at first. Object can be kept in the same place so that the infant can anticipate its location such as a toy tied to the rungs of the crib, an object hung from a mobile. When objects are stabilized, less caregiver assistance may be required.
Cluster 3	Searches briefly for objects lost from grasp not in contact with body	Fraiberg Friedman & Chen Reynell-Zinken	Let infant handle soundless object. Remove it and put it under hands but not touching them. Infant may reach for or make groping movements with hands, searching for object.	As mentioned earlier, when a toy is dropped or taken away, move infant's hands towards it so that the infant can begin to learn to associate the last contact position with the toy's new location. Touching the infant gently under the elbow is one way to provide assistance to encourage hand movement.

Cognitive Development

Process: Spatial Relations [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 3	Reaches for object at midline based upon sound cue alone *(Appropriate for children who are totally blind or who have light perception only.)*	Bigelow Fraiberg	With no prior tactual contact, the infant can regularly reach for and attain a motivating object when it is sounded at midline.	Encourage infant to reach towards caregivers' voices and sound-making objects beginning in the early months of life. Encourage infant to reach out for objects or people at a slight distance at first. Use motivating sounds and in-out movements to encourage this. Push gently under infant's elbow if infant does not touch object without assistance. Use more directive hand-under-hand assistance only if necessary.
Cluster 4	Moves or gestures towards caregiver when called	Reynell-Zinken	When called from across the room by a familiar person, infant reaches or moves towards person.	Infant learns to move in direction of sound source from distance. Practice during interactive play.
	Locates fixed object	Reynell-Zinken	Infant locates familiar object that is encountered daily and whose location remains constant such as highchair, chair, table, door, etc.	Play games that encourage infant to locate toys or persons or objects during daily routines. A favored toy could be the reward when infant locates goal. Keep play spaces, belongings, and toys in consistent locations in infant's room and other areas in which infant spends a lot of time. Encourage the older infant to put toys away when play time is finished to help the infant learn to anticipate their location for the next play time.

Cognitive Development
Process: Problem Solving

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Adjusts in anticipation to lifting	Bayley 1&2	Lying on back, with caregiver's hands under infant's arms in preparation to lift, infant tenses body or shoulders, moves arms in anticipation of impending position change, or displays other motor reaction.	Always gently alert infant verbally and non-verbally before lifting or moving since infant may not have sufficient vision to determine that a position change is about to occur.
Cluster 3	Uncovers toy	Bayley 1 Norris et al.	Place favorite small toy on table. Place tissue paper over toy so that infant can see or feel the process. Infant takes off paper to find the toy.	Help the infant experience the covering, uncovering process in interactive play. Use physical assistance only if needed. Cover a familiar object with a natural cover such as a blanket or cover a cookie with a napkin, for example.
	Pulls string to activate toy *(The attainment age for this item will vary with the cognitive demands of the task.)*	Brambring Friedman & Chen	Infant pulls cord of music toy, pulls string tied to jingle bells.	Infants with vision impairment often require help to learn cause and effect relationships. Provide physical assistance when vision isn't available to take in the whole experience. Infants must have time to explore and examine toys and their parts in order to understand their specific cause and effect relationships.
	Searches for contents of box	Bayley 1&2	Place two large, wooden beads in box without lid and shake gently. Empty beads on table and shake again. Let infant feel beads in box and on the table if necessary. Empty and refill the box. Infant searches for beads independently.	Encourage infant to investigate contents of containers during interactive play. The infant can find cookies in a cookie box, shoes in a shoe box, cereal in a cereal box.

Cognitive Development

Process: Problem Solving [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 3	Puts one object into container on request	Bayley 1&2 Friedman & Chen Norris et al. Reynell-Zinken	Demonstrate desired activity to infant several times, helping infant feel actions if necessary. Infant can place cube in or over cup, block in milk carton, chip in can, etc.	Make game out of dropping wooden objects into metal containers. The infant can hear each object as it hits bottom. Encourage infant to imitate action. Use physical prompts only if necessary.
	Imitates unfamiliar action with object *(The attainment age for this item will vary with the cognitive demands of the specific task.)*	Bayley 1&2 Norris et al.	When a new action is performed that the infant can hear and feel if necessary, the infant imitates the action such as tapping drum, pushing buzzer toy, etc.	Based upon earlier attempts at imitation of actions of others and ability to perform demonstrated action. Use necessary prompts during interactive play to teach a variety of skills.
Cluster 4	Uses objects according to function	Uzgiris & Hunt	Infant uses familiar objects according to their accepted function: dials phone, hits lever, pulls string, stirs spoon, etc. *(Function is related to the object alone, not object in relation to the infant.)*	Infant learns these skills during solitary and interactive play and during course of daily routines. Physical guidance may not be required to demonstrate accepted use of objects since infant may not have sufficient vision to observe objects in use. Use least intrusive physical prompts.
	Puts many objects into container	Bayley 1&2 Norris et al.	Start with about nine objects. Put one object on table. Ask infant to put it in the container. Then put remaining objects on table, asking infant to put all the objects into the container. Infant puts all objects into container independently.	Continue to encourage child to place objects in and out and to dump objects out of containers while listening to the sounds during daily routines (e.g., removing bath toys from a larger container and putting them back at the end of bath time).

Cognitive Development

Process: Problem Solving [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 4	Stacks objects *(Some infants with visual impairment do not stack objects since this task may require visual motivation to complete.)*	Bayley 1&2 HELP Oregon	Infant purposely places two objects on top of one another (e.g., blocks, cups).	Child learns these skills through exposure and repetition during play (e.g., stacking blocks or dishes).
Cluster 5	Relates two objects	Friedman & Chen HELP	Uses two objects that are related to each other: plays xylophone with stick; stirs spoon in cup, etc.	Infants with visual impairment may not be able to observe the relationship of objects by watching others use them. Use physical assistance only when necessary and provide opportunities to feel the actions of a model and hear the sounds made when two objects come together.
	Performs actions with objects in relation to self	Friedman & Chen Uzgiris & Hunt	Infant performs social action: brushes hair, puts on necklace, brushes teeth with toothbrush.	Infant learns these skills during daily routines through exposure and repetition. Encourage infant to perform skills independently when appropriate.
Cluster 7	Assembles and takes apart nesting toys	HELP	Infant independently takes apart and puts together nesting toys (e.g., cups, stacking rings).	Infant learns through exposure and repetition during play and daily routines.

Cognitive Development

SOURCE	POPULATION	TYPE
Bayley 1	normally sighted infants	standardized infant development scale
Bayley 2	normally sighted infants	updated standardized infant development scale
Bigelow	totally blind or light perception; no other disabilities no premature infants	research study
Brambring	totally blind or light perception; includes premature infants and infants with multiple disabilities	research study
Carolina	infants with disabilities	literature review for assessment items
Fraiberg	infants who are totally blind or light perception only; no other disabilities	research and clinical observation
Friedman & Chen	normally sighted and infants with visual impairment	literature review
Haith	normally sighted infants	literature review
HELP	normally sighted infants	standardized infant development scale
Norris et al.	infants who are totally blind, visually impaired; includes premature infants	research study

Cognitive Development [Continued]

SOURCE	POPULATION	TYPE
Oregon	infants who are visually impaired or totally blind	literature review; field test for content validity
Reynel.-Zinkin	infants who are totally blind, visually impaired, normally sighted; includes premature infants and infants with multiple disabilities; age levels derived from Maxfield-Buchholz Scales for children with visual impairment	standardized infant development scale
Uzgiris-Hunt	normally sighted infants	standardized infant development scale

FINE MOTOR DEVELOPMENT

Fine Motor Development

Description

This fine motor development section examines the progressive refinement of hand use for exploration and manipulation.

Explanation

Adaptive use of the hands to obtain information and act upon the environment is critical for infants with visual impairment. The hands of these children are a "window on the world" for a variety of reasons:

- Tactile input is a primary channel for perception when vision is limited or absent, providing direct contact with the environment.
- As infants develop, information derived from tactile stimuli is coordinated with information obtained through other sensory channels to form an understanding of the world.
- Hand movements to obtain sensory information and perform specific tasks become more refined and precise.
- Interaction patterns involving hand use become more complex and purposeful, accompanying the ever-increasing demands of developing cognitive processes.

Fine motor development occurs in conjunction with growth in other developmental domains, integrating input from available sensory channels (Nagaishi, 1993). It not only involves the refinement of manual dexterity skills, but the coordination of hand control with other processes so that infants can extract meaning from their environment and act upon it (Rogow, 1986).

When investigating fine motor development, a number of behaviors are considered at different stages of growth. Difficulties noted in one or a combination of these areas need to be addressed in a timely manner in any intervention program.

Perception	The infant is *aware* of environmental stimuli from available sense modalities including touch.
Discrimination	The infant *notices differences* in perceived stimuli.
Exploration	The infant *examines* stimuli carefully to obtain information.

Prehension The infant *grasps* and *reaches* for perceived stimuli.

Manipulation The infant *handles* objects to produce a desired effect or action.

Ultimate constructive use of the hands is well within the realm of children with visual impairment (Warren, 1994). Careful effort must be made to monitor functional hand use in order to encourage finer degrees of perception, exploration, discrimination, prehension, and manipulation so that the hands of the child with visual impairment "find meaning in experience" (Fraiberg, 1977, p.275). Without an array of hand skills, the foundation for higher level cognitive skills is missing (Friedman & Chen, 1990).

Intervention Concerns

Tactile input is one major source of information by which infants with visual impairment form concepts about their environment. Without adequate ways to access this information, the cognitive skills of these children can be limited. All too often, the hands of visually impaired children become fixed into patterns that interfere with purposeful involvement with the world around them (Rogow, 1986). This is particularly true for children with multiple disabilities. Research related to development and intervention for infants with vision loss has been limited in the area of fine motor development. Nonetheless, parents and early interventionists must consider this developmental domain a crucial concern for infants with visual impairment. Working with occupational therapists or physical therapists familiar with the developmental needs of infants can be of great assistance in this area.

- Ferrell (1985) stresses that promoting the development of fine motor skills related to prehension requires that infants have the **opportunity for continued practice** and that direct teaching may not be necessary. Basic fine motor skills that require opportunities for practice and that do not appear to pose major problems for infants with visual impairment include grasping, releasing, and wrist rotation. Other skills, most notably reaching, may require more direct attention by early interventionists.

  Considerations: Ferrell (1985) indicates that the use of the hands for weight bearing and weight shifting while in the prone position is an important way to promote hand use in addition to promoting hand activities in other positions. She also recommends the introduction of teething rings, canning jar rings, or plastic infant "keys" when the infant is beginning to use the thumb for grasping, and the introduction of small pieces of dry cereal, toys that require filling and dumping, and toys with crevices or recessed parts when a true pincer grasp is emerging.

- Tactile **defensiveness**, a generalized withdrawal from certain types of tactile experiences (Sears, 1994), can discourage infants with visual impairment from engaging in interactions vital to learning.

  Considerations: Positive experiences with a wide array of objects encompassing a variety of sizes, textures, materials, weights, temperatures, and shapes are crucial

for infants with visual impairment. Introduction of materials that children favor while slowly adding ones that the children appear to disfavor can be helpful. Sometimes children will be more accepting of certain textures on specific parts of the body other than the hands. Slowly introduce those textures to the accepting body areas (e.g., feet, legs, arms) and gradually move to the hands when the children have become more accustomed to the textures on the receptive body parts.

- Inefficient hand control can lead to **ineffective object exploration and use** (Rogow, 1988).

  Considerations:

  a. Materials that promote touching, grasping, searching, and reaching must be made available to infants with visual impairment at appropriate developmental stages. At early ages, toys can be tied to such items as high chairs or infant seats using short strings at first so that the infant can easily relocate the toy when it is dropped. The length of the string can be lengthened as the infant's understanding increases (Ferrell, 1985).

  b. Materials for solitary play must be motivating for the children to explore without any caregiver assistance. Ferrell (1985) suggests introducing a variety of finger foods. Nielsen (1991) indicates that tactile exploration can be fostered by a high degree of tactile discrepancy within one object and that comparison of details in two objects requires only moderate tactile discrepancy between the two items. She also notes that infants quickly discontinue their search of objects with smooth surfaces.

  c. For developing infants, it is necessary to incorporate meaningful exploration of objects into daily routines in natural settings. If development appears to be delayed, then strategies must be considered that foster the acquisition of specific skills to promote developmental progress. To this end, it is critical to complement training strategies for specific skills or skills taught in isolated or unusual settings with ones that encourage the transference or generalization of isolated skills learned in training settings to usual life circumstances. Nielsen (1992a, 1992b) has suggested special materials to encourage object exploration for children with visual impairment and multiple disabilities who do not function at expected developmental levels. These include a resonance platform (This is a plywood platform on which objects for exploration are placed. When the child contacts objects on the platform, the duration of sounds produced are longer than those produced on other surfaces, encouraging the child to pursue object exploration.), an activity belt or bib (This is a bib with objects for exploration fastened to it such as wooden beads or a string of pearls to encourage hand use.), and the Little Room (This is a microenvironment in which outside noise is muffled, objects for exploration are placed within reach and in a constant location, and echoes from infant-generated movements and vocalizations are considered clearly perceivable.).

  d. Physical assistance to explore (e.g., a guiding hand under the elbow, caregiver's hand under infant's hand, caregiver's hand over infant's hand) is often necessary when introducing new items to children, modeling ways to explore and manipulate component parts. Every effort must be made, however, to encourage infants to

explore without physical assistance and to gradually reduce any assistance provided. See Hierarchy of Prompts in the chapter, Basic Premises of the Manual, for more information.

e. Hand control can be promoted in conjunction with self-care tasks such as eating and drinking in infants.

f. Materials should be placed in consistent locations so that children know where to expect them in their daily routines. For example, a finger food snack is always presented after a morning nap in the middle of the high chair tray.

g. Some early intervention specialists have noted that infants who are totally blind may tend to persist in the use of a raking motion to reach for small objects. This may be an adaptive response which allows them to search an area as they reach.

- The **continual touching or fingering of objects for sensory stimulation alone**, without making inferences about object properties or use, can be a serious impediment to development.

  Considerations: A more systematic and concentrated intervention is necessary when toddlers and young children show perseveration in this area. Daily introduction of a few extremely motivating objects to explore, using the least intrusive prompt is recommended, coupled with a verbal description of the interactions taking place and positive feedback for the child. For example, a daily routine involving a pleasant-feeling, soft squeak toy that emits a rewarding sound when pushed slightly could be introduced. Children would be encouraged to push the toy on their own to create the sound after positive modeling of exploratory schemes have been presented and repeated. In addition, over the course of the day, children should be encouraged to examine and manipulate objects they encounter whenever possible. While physical assistance is not generally recommended, it may be necessary to introduce this type of prompt when infants do not explore on their own and less intrusive prompts do not elicit meaningful object exploration behavior.

- **Banging or mouthing objects without moving on to other interactive motifs** at appropriate developmental stages can become a stereotyped, non-productive interaction pattern.

  Considerations:

  a. The suggestions to the previous item also apply here. Children with visual impairment must often be shown ways to interact with objects since they cannot see or cannot clearly see what others are doing with them. Again, perseveration in this area requires systematic and concentrated intervention.

  b. In addition, if an infant has a limited repertoire of tactual exploration skills, such as banging or raking movements only, the infant can be given toys that require that type of movement to elicit feedback. For example, if an infant bangs, toys which require a light pat to initiate a sound or a light or a movement can be provided so

that the infant learns to associate their banging movement with a resulting activity. If the infant makes raking movements, toys which require the raking movement to initiate a sound or a light or a movement can be provided (e.g., a textured cylindrical shape on a spindle that spins when lightly raked). The limited repertoire of skills can be directed to activities that provide feedback to the infant. At the same time, those working with the infant must be encouraging the expansion of tactual exploration and manipulation skills, looking for opportunities to respond to the child's interests.

- The **inability to reach for objects** reduces self-initiated contact with the external world and is closely tied to conceptual development (Bigelow, 1986). Consistent caregiver interactions and social bonding from early infancy have been noted to promote reaching (Als, Tronick, & Brazelton, 1980). Reaching is closely associated with the development of object permanence (i.e., an object exists when it cannot be directly perceived). The attainment of this concept occurs in stages as children learn about objects they can touch, as the objects they touch are moved away, and as objects that are silent and that produce sounds are presented with and without any previous tactile contact from various directions (Bigelow, 1986).

  Considerations:

  a. Reaching begins with objects in contact with the infant's body. Reaching for a caregiver's hand or face in contact with the body can be a highly motivating scenario for both infants and their parents.

  b. Bigelow (1986) noted that earliest responses to reaching tasks of various types prior to directional reaching included generalized excitement indicated by hand waving and feet cycling as well as horizontal sweeps of the air in front of the body and the bringing together of hands at the midline.

  c. As infants mature, encouragement to bring hands to midline and to reach for motivating objects and caregivers at midline can be incorporated into their routines. Infants will find it easier, at first, to reach for objects that they have been touching and that are moved slightly away.

  d. Reaching for objects placed to the left or right of midline at chest level occurred later for some infants with visual impairment, but reaching for objects higher or lower than midline at chest level was clearly more difficult for all infants with visual impairment in one study (Bigelow, 1986). Sonksen (1979) recommends that a sound source be presented at midline and slightly to each side of midline. Begin with the familiar sound of the caregiver's voice then move to the sound of milk in a bottle, being careful to bring the infant's hands to the sound source to confirm the auditory impression with a tactile one.

  e. Bigelow (1986) noted that tasks with continuous touch cues elicited directional reaching more readily than tasks with continuous sound cues for the infants with

visual impairment in her study. Reaching for distal objects based on sound cue alone is a later development than reaching for objects in tactual contact. Sonksen and her colleagues (1984) recommend that, when reaching for an object based upon its sound alone, the sound source should remain stationary as the baby begins to move towards it. In initial interactions, they also recommend moving the infant's hands to the sound source to prevent confusion about its location.

f. Also noted by Bigelow (1986) was that when touch and sound cues were in conflict, the infants with visual impairment in her study relied on strategies based upon touch cues (e.g., If a continuous sound-making toy was dropped or moved to a second location, the children in Bigelow's study at certain developmental stages first searched for the toy where it was last touched rather than locating it from its continuous sound at a new location).

g. If an infant requires a physical prompt when learning to reach, begin by using a system of least prompts, helping the child move from the shoulder or with gentle support under the elbow before providing full physical assistance. Work from behind so that infants experience a gentle pushing rather than pulling sensation (Ferrell, 1985).

h. Ferrell (1985) also recommends that once infants have learned to reach, motivating objects can be placed a little further than arm's length and infants can be assisted to lean forward or stretch an arm if they miss the object.

i. Infants with visual impairment, especially those with additional disabilities, may benefit from the provision of verbal feedback about an object's location (e.g., "Try again, you almost found it") as well as encouragement to use two hands for reaching since they cannot rely on vision as a way to check their reaching errors, according to Ferrell (1985).

- Barraga (1986) considers the **development of tactual kinesthetic perception** leading to awareness of graphic representations and braille symbology to begin with awareness and attention to differences in such characteristics as textures, temperatures, and materials. Next there is perception of structure and shape through manipulation of objects, followed by relating parts to the whole as things are taken apart and put together.

  Considerations: Early tactual exploration and discrimination experiences provide the prerequisites for the controlled hand movements and fine discriminations necessary for braille reading. Infants with visual impairment benefit from all meaningful fine motor experiences including the use of two hands together for exploration and manipulation.

Opportunities for Learning

Proficiency in fine motor skills can be encouraged by creating the following opportunities for learning:

- Providing appropriate materials at different developmental stages for exploration/ manipulation in a variety of positions (e.g., sitting, lying on back, lying on stomach)
- Providing materials in expected locations during routine daily activities in various positions (e.g., a sponge in a bathtub, a bowl on a highchair tray)
- Interacting with caregivers to encourage object exploration, exploration of infant's body parts as well as caregiver's face and body parts
- Providing activities to encourage engagement of hands at midline at appropriate developmental stages
- Encouraging reaching for sound-making and silent objects when in direct contact and when slightly separated from infants at appropriate developmental stages

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Fine Motor Development Charts

The development of fine motor skills and behaviors in visually impaired infants has been examined in terms of three processes. Indicators for these processes are listed in the corresponding charts that follow. The charts can be used to help determine critical skills and behaviors to consider for intervention with individual infants.

For each process, determine the developmental cluster for an infant by identifying the skills and behaviors that an infant has attained. Then use the skills and behaviors within that developmental cluster or at the next developmental cluster as guides when devising an intervention program for the child. (Note: Some infants may have skills and behaviors in more than one cluster in a developmental process.)

Process **Prehension**

The infant grasps and reaches for perceived stimuli.

Process **Exploration**

The infant handles objects carefully to obtain information about their attributes.

Process **Manipulation**

The infant handles objects to produce a desired effect or action.

Fine Motor Development

Process: Prehension

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Retains object placed in hand	Bayley 1&2 Norris et al. Reynell-Zinken	When an object is placed in infant's hand, infant can retain hold of it.	Provide gentle finger play with infant's hands as part of early interactions. Provide play with objects the infant can grasp.
	Reaches for and picks up objects *(does not apply to totally blind children)*	Bayley 1&2 VIIRC	Infant can pick up object within easy reach.	Encourage infant to reach toward objects, caregiver's face, and favored sound-making toys. Present toys at midline at first. Then move to other locations once this is achieved. Have infant explore objects tactually before presenting them out of reach. When first presenting objects out of reach, bring infant's hands to the object using least physical prompt.
	Uses whole hand to grasp	Bayley 1&2	When an object is placed in infant's hand, infant uses whole hand to grasp it.	Routinely provide variety of safe graspable materials for infant to explore with hands during solitary and interactive play.
Cluster 2	Reaches unilaterally	Bayley 1&2 Norris et al.	With an object in contact with body, infant more often reaches for it with one hand than with both hands.	This skill is based upon early experiences with objects. Use physical prompts to encourage reaching only when necessary. Fade to less support when possible.
	Partial thumb opposition	Bayley 1&2	Infant can pick up and hold objects with thumb and fingers in opposition. May use palm also.	Provide favorite finger foods and motivating objects for grasping. Remember to include some new items as well as familiar ones.
	Uses pads of fingertips to grasp small object	Bayley 1&2 Norris et al.	Infant can consistently oppose thumb to any four fingers in picking up or holding small objects such as a cube.	This skill is based upon early experiences exploring small objects such as cereal.
Cluster 3	Uses pads of fingertips to grasp very small object	Bayley 1&2	Infant can pick up very small object such as a raisin, with thumb and pad of any finger.	Encourage infant to explore small objects such as small pieces of cereal while supervised during daily routines. Since small objects can be accidentally swallowed, care must be taken to encourage this skill safely. Slightly moist fingers will allow cereal to stick.

Fine Motor Development

Process: Exploration

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Attempts to bring hand to mouth	Bayley 1&2	Infant purposefully attempts to place a hand in mouth. Infant need not succeed.	Provide tactile stimulation of infant's hands with caregiver's hand, soft textures, etc.
	Fingers hand in play	Bayley 1 Norris et al.	Infant can playfully finger one hand with other when encountered by chance.	Encourage infant to explore own hands during interactive play. Place cloth or other "bracelets" around infant's wrist for exploration. Frequently present materials at midline during interactive play.
	Brings object to mouth *(also in Cognitive Development section)*	Bayley 1&2 Reynell-Zinken	Infant can sometimes bring objects held in hand to mouth.	Provide motivating objects such as soft and hard rattles, cloth of different textures, and rubber teething rings of various textures to encourage this skill.
	Uses hands for purposeful action	Bayley 1 Norris et al.	Infant can intentionally use hands to crumple, bang, rattle objects.	Provide opportunities for child to practice during interactive games and routine activities. Provide little buckets and floating toys during bath time, soft textured toys on changing table, furry toys in crib.
Cluster 2	Transfers object hand to hand	Bayley 1&2 Norris et al. VIIRC	Infant purposely moves small object from one hand to the other.	Place favored object in infant's least favored hand in order to encourage use of that hand and transfer of object to favored hand.
	Retains 2 objects *(also in Cognitive Development section)*	Bayley 1&2	When two familiar objects of interest are placed one in each hand, the infant holds the objects for 3 seconds or more.	Infant is learning to make distinctions between two objects held simultaneously. Provide practice by placing objects in each hand. If infant is not ready, one item will be dropped or disregarded.

Fine Motor Development
Process: Exploration [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 2	Brings objects to midline *(also in Cognitive Development section)*	Bayley 1&2 Brambring	Infant can purposefully bang two small objects together at midline such as spoons or cubes.	Based upon early skills related to object exploration. Objects should be tactually and auditorally interesting to the infant. Encourage child to bang by banging in imitation as a reward.
	Fingers holes in pegboard	Bayley 1&2	Infant intentionally pokes finger into at least one hole after demonstration (hand-over-hand if necessary).	Encourage infant to examine surfaces and textures by providing motivating play material during daily routines. Infant can play with large empty spools of thread or open weave baskets.
	Explores different textures *(also in Cognitive Development section)*	Norris et al. Reynell-Zinken	Infant is interested in toys or objects of different textures such as stuffed animals, metallic toys, sandpaper, smooth toys, prickly toys, etc.	Provide opportunities and encourage infant to play with objects of different textures. If any resistance occurs, present textures on most receptive body parts, gradually working towards acceptance by the hands. Be certain to encourage the infant to actively explore and differentiate textures. Encouragement to explore textures during daily routines is recommended (e.g., playing with toys of different textures; wearing and exploring clothing made with corduroy, Angora, quilted material).
Cluster 3	Plays pat-a-cake	Bayley 1 VIIRC	Infant can bring hands together at midline without adult assistance.	Infant is encouraged to play interactive hand games with caregiver, first with assistance, then without. Use physical prompts only when needed. The child could also be asked to place his or her hands on the caregiver's hands. (especially important for infants who are totally blind).

Fine Motor Development
Process: Manipulation

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Plays with toys that produce sound	Bayley 1&2 Norris et al.	Infant attends to playful activity with toys such as shaking or chewing a rattle.	Appropriate toys and caregiver interaction to promote play can encourage this behavior. Caregiver can imitate infant's actions such as shaking a rattle when the child shakes as rattle.
Cluster 2	Uses object to bang surface *(also in Cognitive Development section)*	Bayley 1&2	Infant purposely bangs in play using an object to bang the table or other surface.	Assist infant in performing these actions with objects that provide feedback since infant may not see well enough to imitate actions of others. Imitate banging when infant bangs to further encourage this behavior.
	Pulls objects out of container	Norris et al.	Infant can consistently pull out objects from slots such a large pegs from pegboard.	Put favorite toys in containers for infant to explore and pull out. Encourage child to replace toys in container when play time is over.
	Manipulates objects with interest in moving parts	Bayley 1&2 Norris et al.	Handles objects with clear interest in details of moving parts such as a bell.	Provide motivating objects for exploration. Toys that emit sounds when simple parts are moved slightly encourage exploration.
	Puts small object in container on request	Bayley 1&2	Demonstrate desired activity to infant several times, helping infant feel actions if necessary. Infant can place cube in or over cup, block in milk carton, chip in can, etc.	Have infant explore objects in containers. Provide physical prompts only when needed. Infant can play with bath toys in bucket at bath time, rattles in metal containers at play time.

Fine Motor Development

Process: Manipulation [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 3	Uses one hand to stabilize object while other hand manipulates *(The attainment age for this item will vary with the cognitive demands of the specific task.)*	Bayley 1&2 Friedman & Chen	Infant uses one hand to stabilize object while manipulates second object with other hand: turns pages of book while holding, holds drum and hits it, places one hand on container while putting objects in and out, etc.	Infant needs experiences that encourage this skill. Begin by encouraging use of both hands playing in water, sand, or cornmeal. More complex tasks can be added as infant gains competence in using both hands in simple exploration tasks for older infants. Demonstration of methods to stabilize objects may be required. An accordion toy also encourages use of two hands.
Cluster 4	Places one peg repeatedly into hole	Bayley 1&2 Norris et al.	Infant places two or more pegs into hole or one object in and out two or more times.	Provide toys that encourage this skill such as putting plastic eggs in empty egg cartons or people in a toy bus for older infants. Provide physical assistance only when needed. Provide objects with high contrast to promote use of vision as appropriate.
	Throws object	Bayley 1&2	Infant can intentionally throw small objects such as a ball.	Infant can be encouraged to throw object that results in an interesting sound or in interactive exchange with a person.
Cluster 5	Manipulates objects using fingers *(The attainment age for this item will vary with the cognitive and motor demands of the specific task.)*	Bayley 1&2	Infant pulls zipper tab, removes plastic lid from container, etc.	Provide infant opportunities to explore zippers on various clothing items, Velcro closures on clothes and toys. Put motivating object in container with infant's help and encourage infant to open container. Provide assistance only if necessary.

Fine Motor Development

SOURCE	POPULATION	TYPE
Bayley 1	normally sighted infants	standardized infant development scale
Bayley 2	normally sighted infants	updated standardized infant development scale
Brambring	infants who are totally blind or with light perception, includes premature infants and infants with multiple disabilities	infant research study
Fraiberg	infants who are totally blind or with light perception only; no other disabilities	research and clinical observation
Friedman & Chen	normally sighted and infants with visual impairment	literature review
Norris, et al.	infants who are totally blind, visually impaired; includes premature infants	research study
Reynell-Zinkin	infants who are totally blind, visually impaired, normally sighted; includes premature infants and infants with multiple disabilities; age levels derived from Maxfield-Buchholz Scales for children with visual impairment	standardize infant development scale
VIIRC	infants who are totally blind, visually impaired; includes premature infants; data for infants with multiple disabilities available but not included here	research study

GROSS MOTOR DEVELOPMENT

Gross Motor Development

Description

This gross motor development section examines the coordination of purposeful movement of the whole body in space involving large muscle groups in such activities as crawling or walking.

Explanation

Movement in space provides infants with visual impairment with increased access to external stimulation (Adelson & Fraiberg, 1977). As infants mature, their developing gross motor system supports and promotes increased interaction with and understanding of the environment. Physical movement becomes a way to promote these interactions as well as an intrinsic source of pleasure.

Gross motor function examined at different developmental stages includes a variety of interrelated characteristics, capacities, and skills which must be addressed in intervention programs:

Primitive Reflexes — The infant exhibits *automatic reactions to external stimuli* which appear during gestation or at birth and become integrated during the first year of life in normally developing infants. (Example: When lying on his or her back at 4 weeks, the infant's head turns in the same direction as an arm outstretched to one side -- the asymmetric tonic neck reflex.)

Posture — The infant maintains *body alignment* that promotes optimal movement. (Example: Independently sitting with straight back.)

Tone — The infant's *muscular system is in a balanced resting state* of tension and contraction that supports controlled motor activity. (Example: With too little tone, the infant's limbs feel floppy when moved (i.e., hypotonia). With too much tone, the infant's limbs feel tight when moved (i.e., hypertonia).

Balance	The infant learns to *adjust positions* when the body's center of gravity is not within the base of support. (Example: Young infants learn to hold their heads erect.)
Strength	The infant demonstrates *necessary muscle power* to perform activities and maintain good stability. (Example: A sitting position is maintained for an extended period of time.)
Righting, Protective, and Equilibrium Reactions	The infant makes *automatic and compensatory postural adjustments and/or righting movements* when moved off balance. (Example: When sitting and pushed off balance to one side, the infant extends an arm out and toward the floor on the side of the direction of the fall.)
Rotation	The infant *moves one portion of the trunk while keeping the rest stationary.* (Example: When sitting on the floor, the infant turns only the upper portion of the trunk to look behind.)
Coordination of Movements	The infant makes *smooth transitions* from one position to another. (Example: In moving from a prone to a sitting position, the infant turns to one side and pushes up with little or no additional turning.)
Sensorimotor Integration	The infant *organizes input from various sensory systems prior to making a response.* (Example: When hearing a familiar squeaky "porcupine" toy, the infant associates the texture of the toy with the sound and picks up that toy more carefully than a fuzzy, soft toy.)
Motor Planning	The infant can *logically carry out a sequence of actions* resulting in the successful completion of a motor task. (Example: The older infant learns to kick a ball accurately that is rolled from various directions.)
Locomotion	The infant *moves from place to place independently.* (Example: Creeping)
Conceptual Understanding	The infant develops an *understanding of body parts, body position in space, objects, and objects in space.* (Example: The infant understands that the floor is below when held upside-down in play by a caregiver.)

Optimal gross motor development depends upon the integration of a variety of complex factors

that change as the infant matures. While gross motor skills need not be a difficulty for infants with visual impairment, without proper guidance to promote coordinated and fluid movements at different developmental stages and without appropriate motivation to move and to explore, problems can arise (Adelson & Fraiberg, 1977; Jan, Freeman, & Scott, 1977).

Intervention Concerns

Infants with visual impairment must learn to initiate and refine motor movements with limited or no access to visual feedback. Working with physical therapists and occupational therapists, as well as orientation & mobility specialists who are familiar with the developmental needs of infants can be of great assistance in preventing and overcoming difficulties in this area.

- A large percentage of congenitally visually impaired children have been documented to have **low muscle tone**, and this was found more frequently in children with light perception or less. Delay in early motor development was associated with low muscle tone (Jan, Robinson, Scott, & Kinnis, 1975). The reason for low muscle tone is still not clear. Lack of opportunity to master early motor skills has been postulated (Jan et al., 1975), and Ferrell (1985) encourages movement experiences for infants with visual impairment. Another theory offered is that visually impaired infants are not motivated to raise their heads in early infancy with no visual lure when in the prone position. This leads to poor postural tone and other postural anomalies (Brown & Bour, 1986). The prone position is considered vital for the development of balance skills as well as a prerequisite for the development of the arm and trunk strength necessary for reaching (Hart, 1983).

  Considerations: Since visually impaired infants often dislike the prone position, it is important that these children experience the position in positive ways from early infancy (Ferrell, 1985). Lying prone on the caregiver's stomach with gentle verbal and tactile feedback may be more accepted by some infants. See Hug, Chernus-Mansfield, and Hyashi (1987) and Hyvarinen (1988) for additional details about other strategies that encourage the prone position. Assistance from a physical therapist in moving resistive infants into the prone position should be considered. Placement of toys and materials should be designed to encourage infants to raise their heads. Caregivers can also encourage interactions and head-raising from this position. Once infants can maintain the prone position for several minutes, they can be encouraged to reach for toys and caregivers from the prone position.

- Understanding the concept of the floor as a continuous and hard surface may be difficult for infants with visual impairment and can affect the acquisition of **protective reactions** (Sonksen, Levitt, & Kitsinger, 1984). The first protective reaction to emerge is a downward one. When the infant is upright and is moved towards the ground, the legs are extended. This is followed by a forward protective reaction in which an infant extends the arms when moving forward toward a surface. Next come the sideways and backward protective reactions, although the sideways reaction sometimes overlaps with the forward reaction.

  Considerations: Sonksen and her colleagues (1984) present several excellent suggestions to train this concept, and they will be mentioned in detail here since they work well with infants with visual impairment. Have the visually impaired infant sit in a caregiver's lap on the floor. The caregiver can then gently sing and rock side to side so that the baby contacts the floor on each side with arms outstretched.

When the infant appears to anticipate the floor with a preparatory hand movement, the caregiver can then change the rocking angle diagonally, forwards, and backwards. For the downward parachute reaction, bounce the infant up and down from the floor at the same height until an anticipatory response is noted, then bounce the infant at different heights. For the forward parachute, the caregiver can kneel on the floor with the baby sitting on the caregiver's knees, feet on the ground. The infant can gently be moved forward until the hands touch the floor, and then rocked backward.

- Reduced opportunity to observe and emulate the motor movements of others can result in **limited skill repertoires** (Adelson & Fraiberg, 1977).

  Considerations: Encouraging infants with visual impairment to engage in new movements during interactive play sessions can lead to their eventual incorporation into behavioral routines. Movement games, games that single out specific body parts for touch and movement, and some playful hand-over-hand exercises can promote novel movement patterns. Infants with visual impairment can also be encouraged to explore the arms, legs, hands, feet, and faces of others. Hand-over-hand demonstration of activities may be necessary for some children, although use of physical assistance should be considered only when necessary. (See the section on Hierarchy of Prompts in the chapter, Basic Premises of the Manual.)

- Lack of visual feedback may lead to **reduced interest in repetitive motor play** to perfect motor patterns (Adelson & Fraiberg, 1977; Sonksen et al., 1984).

  Considerations: For younger infants, attaching a bracelet (a cloth pony-tail holder is excellent) with bells around the wrist or ankle can provide additional sensory feedback and promote increased interest in motor play. For older infants, in addition to the bracelets, positive verbal comments and encouragement from a caregiver can stimulate interest in repeating behaviors (e.g., "Oh, you're moving your leg up, up, up. Yeah!") as can actions performed with music as a reinforcer.

- Coordination of movements as the infant **transitions** from one position to another may be affected by poor postural tone, lack of effective proprioceptive feedback, and other factors directly and indirectly related to visual loss (Brown & Bour, 1986).

  Considerations: Encouraging infants with visual impairment to move and to explore familiar surroundings can lead to greater motor experience and effectiveness. Children must be safe and motivated to locate objects or special spots for play. Activities can be included that promote transitional motor skills such as crawling through tunnels, stepping in and out of boxes or buckets, walking on uneven surfaces. Consult a physical therapist for specific exercises to promote coordinated positional changes if necessary.

- Certain **stereotyped behaviors** (unusual repetitive actions which are sometimes called

mannerisms or stereotypies) seen in visually impaired children, such as rocking and head turning, may be partially related to lack of mobility early in life (Jan et al., 1977). These behaviors may serve two very different functions for infants: (1) as ways to heighten arousal levels when children are understimulated or (2) as mechanisms to lower arousal levels when overstimulated (Brambring & Troster, 1992; Jan et al., 1977; Warren, 1984).

Considerations: Prevention is considered more desirable than later intervention, especially since some of these behaviors may compensate for physical and environmental deficits. Recommendations include carrying visually impaired children at early ages to provide stimulation rather than allowing them to remain stationary for long periods of time, encouraging mobility, and exposing children to a wide variety of experiences that promote mastery of cognitive and motor skills (Jan et al., 1977).

- Infants with visual impairment have less time to react to **sudden changes** in their surroundings and to sudden shifts in position without the strong anticipatory cues provided by visual images (Hart, 1983; Sonksen et al., 1984).

  Considerations: It is important to give infants who are visually impaired cues before moving them, placing something in their hands, or when feeding them (Sonksen et al., 1984). The cues can be verbal and/or tactual (e.g., tapping an infant gently on the shoulder and saying, "It's bath time, let's go." before picking up the child). Predictable surroundings are important for children with visual impairment. Help the children learn about the structure and location of frequently used rooms and areas. When developmentally appropriate, have the infants help when an item needs to be moved so that they know where it comes from and where it has gone. Some sudden changes can be detected by understanding the meaning of environmental sounds. Help infants identify environmental sounds and have them experience what the sounds mean whenever possible (e.g., a loud, low hum is a vacuum cleaner, a constant buzzing sound is the timer for the stove). When developmentally appropriate, explain the significance of sounds that cannot be directly experienced, especially to allay fear (e.g., Thunder means it is going to rain and rain.). Sudden changes, however, are an unavoidable part of life. Children with visual impairment must be supported in learning how to manage them in an effective and confident manner. This underscores the need to promote protective extension and balance responses as mentioned earlier.

- Lack of visual feedback can lead to **decreased confidence** in postural mechanisms and fear of exploring the unknown (Sonksen et al., 1984).

  Considerations: As mentioned earlier, encouragement to explore the surroundings, both familiar and unfamiliar, is necessary for infants with visual impairment. They must feel secure in their familiar environments and with their movements in them, so that they feel confident about moving into unfamiliar environments. Caregivers

must be encouraged to allow exploratory behavior. Practice with adult assistance, walking on uneven surfaces and stairs is recommended.

- Formation of an **inaccurate image of the body** can affect the acquisition of movement skills (Cratty & Sams, 1968).

  Considerations: Encouragement of solitary and interactive play with body parts can increase awareness of them. It is important that infants with visual impairment explore their hands, feet, etc., but not become stuck in these experiences so that they fail to move on to object exploration and persist in non-productive perseverative actions. Naming and touching of body parts during usual daily activities can be pleasurable for both infant and caregiver.

- Infants with visual impairment may require planned opportunities to encourage the formation of concepts about objects that serve as motivators for movement as well as concepts about the positions of those objects in pace (Adelson & Fraiberg, 1977; Bigelow, 1992; Schwartz, 1984). An underlying **conceptual base** must be developed to encourage infants to move toward a desired goal.

  Considerations: For children who are totally blind, object permanence (i.e., the infant understands upon hearing a sound that the object emitting that sound exists) and integrating sensory input relating objects at a distance (e.g., What object emits that sound? Where is it in space? Is the object moving?) develop from repeated and meaningful interactions with caregivers and objects from early infancy. Providing experiences with objects in contact with the infant's body, then at a slight distance at midline, then left and right of midline, then above and below midline help to encourage the development of object permanence (i.e., Objects exists when they cannot be seen or felt). Children with visual impairment may need assistance understanding the relationships among various sensory cues (e.g., visual if available, sound, temperature, pressure) to assist in reinforcing concepts about objects. Experiences should slowly and systematically move outward from an examination of the infant's body, to objects touching the body, to objects in larger regions of space (Hyvarinen, 1988). With a firm cognitive base, there is more motivation for movement.

- Research regarding gross motor functions in infants with visual impairment indicates that there *may* be a slight difference in the developmental sequence for infants who are *totally blind*. They may not raise their head and chest while prone until they can roll over from the back to the stomach (Adelson & Fraiberg, 1977). There can also be delays in the achievement of some milestones related to self-initiated mobility which are more likely for infants who are *totally blind*, (i.e., developmental items such as elevates self by arms, creeping, raises self to sitting position, stands up by furniture, walks alone three steps, walks alone across the room). Not all infants with visual impairment will experience these delays (Adelson & Fraiberg, 1977; Brambring, 1992; Ferrell, et al., 1990; Norris, Spaulding, & Brodie, 1957). Furthermore, the quality of acquired movements has been called into question in addition to milestones for movement acquisition for visually impaired children based upon observation by movement experts (Anthony, 1993; Brown & Bour, 1986; Hart, 1983; Jan, et al., 1977). Sonksen (1983) also notes qualitative differences in the static postures of

infants with visual impairment such as sitting. These **behavioral differences for visually impaired children** in infancy and beyond are likely to be related to learning opportunities in infancy (Warren, 1994).

Considerations: Ferrell (1985), Hug, et al. (1987), Hyvarinen (1988) and Langham (1995) provide excellent intervention and play strategies designed to encourage the development of gross motor skills necessary for self-initiated mobility for infants with visual impairment. Their suggestions are numerous and detailed, and include such activities as:

a. Play situations to encourage infants to raise their heads (e.g., while the caregiver is lying down, the infant rests on the caregiver's stomach in the prone position. The infant's back and neck are stroked and buttocks are pressed gently while the caregiver talks to the infant)

b. Ways to encourage the infant to turn from side to side (e.g., use a blanket swing)

c. Methods to encourage infants to creep (e.g., create a sling with a folded terry-cloth towel, drawing the sling under an infant who is on all fours, gently lifting the infant upward and forward to lift the infant's abdomen and encourage weight bearing on palms and knees, while encouraging the infant to move forward to a motivating object or person)

d. Ways to encourage hip rotation, a prerequisite for a normal walking pattern (e.g., encourage reaching with one hand when the infant is on hands and knees)

e. Methods to introduce movement while standing (e.g., stand the infant in a sturdy cart, and while child holds handle for support, pull the cart forward)

f. Methods to encourage walking (e.g., while the caregiver walks backwards, the infant who is ready to start walking can hold onto the caregiver's legs to learn the walking pattern.)

- **Orientation and mobility** refers to knowing one's position in the environment and moving from one location to another in it. Early sensory development, concept development, motor development, and environmental awareness contribute to safe and efficient travel in later years (Hill, Rosen, Correa, & Langley, 1984). **Travel tools** are now under consideration as viable options for very young children with visual impairment. Research evidence regarding the efficacy of such devices, when to introduce them, and how to introduce them is currently not available (Leong, 1996). Introduction of any travel tool for infants should involve an evaluation for any contraindications by a physical therapist (Pogrund, Fazzi, & Lampert, 1992) as well as an evaluation by an orientation and mobility specialist familiar with the needs of infants, especially for long cane use (Pogrund, 1995a).

  Considerations: Devices for young children include modified long canes (kiddie canes), adapted canes, or alternate canes (called precane or noncane devices such as

modified hula hoops that are pushed along the floor) (Joffee, 1995). Travel tools such as push toys with a secure base of support as well as long canes and other adapted travel tools probe the environment, provide information about the ground surface ahead, and serve as bumpers (Langham, 1995). Mobility devices are introduced to infants as they approach or have mastered independent walking (Anthony, 1993). The ability to walk independently with adequate balance and the ability to hold the long cane are prerequisites for introducing the long cane to very young children and use of travel tools should be integrated into usual daily routines (Pogrund, 1995b).

Opportunities for Learning

The following opportunities for learning promote effective gross motor development:

- Placing the infant in the prone position in early infancy to encourage head control and trunk strengthening as well as placement in the supine, sidelying, and sitting positions
- Playing games that encourage the infant to explore body parts to promote the development of an accurate body image
- Supporting rough-house games during playtime with caregivers
- Encouraging balance and protective extension reactions at appropriate developmental stages
- Encouraging goal-directed movement to people, sound-making or musical toys, and softly illuminated objects
- Encouraging infants to locate objects and return them to fixed locations to remote early spatial location skills
- Providing appropriate materials to encourage association of objects with the sounds they emit at appropriate developmental stages, especially for infants who are totally blind
- Physically guiding the infant through critical movements when cognitive and motor prerequisites for that movement are in place, especially those they might not be able to imitate without sufficient vision

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Gross Motor Development Charts

The development of gross motor skills and behaviors in visually impaired infants has been examined in terms of three processes. Indicators for these processes are listed in the corresponding charts that follow. The charts can be used to help determine critical skills and behaviors to consider for intervention with individual infants.

For each process, determine the developmental cluster for an infant by identifying the skills and behaviors that an infant has attained. Then use the skills and behaviors within that developmental cluster or at the next developmental cluster as guides when devising an intervention program for the child. (Note: Some infants may have skills and behaviors in more than one cluster in a developmental process.)

Process **Balance or Movement in Stationary Position**

The infant balances or moves one major body part or section.

Process **Transitional Movements**

The infant moves from one position to another.

Process **Locomotion**

The infant moves his/her whole body in space.

Gross Motor Development

Process: Balance or Movement in Stationary Position

CLUSTER	BEHAVIOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Lifts head when held at shoulder	Bayley 1&2	While held in an upright position, with head resting on shoulder and caregiver's hand on back for support, infant can hold head erect for 15 seconds when hand is removed as appropriate to infant's ability.	Encourage infant to attend to caregiver's face and voice at infant's face level. For the totally blind infant, assist the infant as appropriate to place hands on caregiver's face.
	Holds head steady while being moved	Bayley 1&2 Norris et al.	While being carried and moved, infant can hold head erect.	Provide playful movement experiences for infant that promote this skill.
	Elevates self by arms *(This item may come after "Roll over from back to stomach" for totally blind infants or those with light perception only. Fraiberg, 1977)*	Bayley 1&2 Fraiberg	While on stomach, infant can voluntarily lift head and shoulders up by forearms or elbows.	Encourage infant to play in prone position since this can promote head control, postural tone, as well as trunk and arm strength for reaching and for mobility. For example, when caregiver is lying down on back place child in prone position on caregiver's stomach. Caregiver can talk and play with infant.
	Maintains head at 90 degrees and lowers with control	Bayley 2	When infant is lying on back, infant lifts head 90 degrees briefly and lowers head in controlled fashion	Reward infant with gentle tactile and verbal feedback. Use of sound-making toys or toys providing olfactory input to encourage head lifting may prove helpful.
	Shifts weight on arms	Bayley 2	When resting on extended forearms with head erect, infant shifts weight from one arm to the other.	Place infant in prone position to gain experience with weight bearing on arms. Make it an enjoyable experience for the infant. This is a necessary prerequisite for reaching.

Gross Motor Development

Process: Balance or Movement in Stationary Position [Continued]

CLUSTER	BEHAVIOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Sits alone momentarily	Bayley 1&2 Fraiberg Norris et al.	When placed in sitting position, infant can sit alone for a few seconds when hand support is removed.	Give infant opportunity to sit during daily routines as appropriate. Prop the infant against a large box, laundry basket, or bed rest for intermediate sitting support.
Cluster 2	Sits alone steadily	Bayley 1&2 Brambring Fraiberg Norris et al. VIIRC	When placed in sitting position, infant can sit alone with no support for at least 60 seconds.	Based upon earlier experiences with head control and balance. Provide opportunities for assisted sitting with caregiver and, later, with physical props (e.g., high chair).
	Grasps foot with hand	Bayley 2	While lying on back, infant uses one or both hands to grasp foot.	Encourage infant to explore feet. Involve feet in interactive games. Rub infant's feet, tickle with feather, play singing games that involve feet to encourage awareness.
	Shifts weight while standing	Bayley 2	When standing, infant lifts either foot and replaces it in the same position with or without support.	During interactive games with caregiver, encourage weight shifting while standing. This skill is a necessary prerequisite for walking.
Cluster 3	Rotates trunk while sitting alone	Bayley 2	When seated unsupported on floor infant rotates trunk to reach for a bell, other object, or caregiver to either side without moving from seated position.	While in sitting position, encourage infant to touch objects or caregiver touching the infant's side. Move infant's arm to touch object or person at first. If object is not in direct contact with infant, move infant's hand to object, if necessary, especially for totally blind infants.
Cluster 4	Stands alone	Bayley 1&2 Brambring Fraiberg Norris et al.	Once infant is placed in standing position, infant can maintain position for at least 5 seconds.	Encourage practice during interactive play with caregiver.

Gross Motor Development

Process: Transitional Movements

CLUSTER	BEHAVIOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Rolls voluntarily from side to back	Bayley 1&2	Infant can roll from side to back.	Reward infant with gentle tactile and verbal feedback. Help infant move through positions at first. Repetition may be helpful. Use a readily visible and/or sound-making toy, slowly moving it out of view for infants with usable vision.
	Rolls from back to side	Bayley 1&2	Infant can voluntarily roll from back to side.	Reward infant with gentle tactile and verbal feedback. Help infant move through positions at first and use readily visible and/or sound-making toys to encourage a response.
Cluster 2	Pulls to sitting position	Bayley 1&2	While lying on back, infant pulls to sitting, grasping on to caregiver's hands.	Encourage infant to pull to sit during interactive play. Trunk strengthening activities help promote this skill. Help infant move through positions at first.
	Rolls from stomach to back	VIIRC	Infant can voluntarily roll from stomach to back.	Reward infant with gentle tactile and verbal feedback. Help infant move through positions at first and use readily visible and/or sound-making toys to encourage a response.
	Attempts to raise self to sit	Bayley 1&2	While lying on back, infant attempts to raise head and shoulders.	Provide motivation for child to attempt to change positions in daily routine by talking to the infant or by encouraging the infant to touch or reach for toys.

Gross Motor Development

Process: Transitional Movement [Continued]

CLUSTER	BEHAVIOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 2	Rolls from back to stomach	Bayley 1&2 Brambring Fraiberg VIIRC	While lying on back, infant rolls from back to stomach.	Reward infant with gentle tactile and verbal feedback. If the infant is resistant to rolling onto stomach, move gradually.
	Pulls to standing position	Bayley 1&2 Norris et al.	While holding adult's hands, infant can pull self into a standing position (from supine position). Adult provides no pulling assistance.	Encourage interactive games in which the infant moves up and down, gradually providing less assistance as the infant gains more control.
Cluster 3	Raises self to sitting position	Bayley 1&2 Fraiberg Norris et al.	From supine, prone, or side position, infant can pull self into sitting position using furniture or other objects for support.	During solitary and interactive play periods, provide the infant with items in the surroundings that will motivate infant to perform this skill (e.g., favorite toys that can be reached from sitting position only and objects that enable the infant to pull to a sit).
	Moves from sitting to creeping	Bayley 1&2	Infant moves from sitting position onto hands and knees.	Encourage the infant to creep towards a caregiver or favorite object. If helpful, use toys with lights that are appealing but not overwhelming to attract the infant with usable vision. For infants with no usable vision, they must understand the existence of an object based upon sound cue alone for a sound-making object to be an effective motivator. For some infants, it may be helpful to let them hold the motivating object and then move it only slightly away to encourage the child to move toward it.

Gross Motor Development

Process: Transitional Movements [Continued]

CLUSTER	BEHAVIOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 3	Pulls to stand at furniture	Bayley 1&2 Brambring Fraiberg Norris et al.	Infant can use object to raise self to standing position.	During solitary and interactive play provide infant with items in the surroundings that will motivate infant to perform this skill (e.g., favorite toys that can be reached from standing and objects that enable the child to pull upward). Consult with a physical therapist if, when rising, the infant extends both legs simultaneously and goes up on the toes rather than bending one leg to push up.
	Sits down	Bayley 1&2 Norris et al.	Infant can lower self from standing position to sitting position in a controlled manner.	Encourage practice during interactive play with caregiver. As an intermediate step, the infant can lower to a box, bolster, or the caregiver's knee to lessen the distance between the standing and sitting positions.
Cluster 4	Moves from supine to standing position	Bayley 1&2	When infant is on back on floor, infant can roll onto side, then stand without support from furniture.	Opportunities to move during interactive play with caregiver promote this skill.
	Bends down to pick up objects	Bayley 2 Brambring	Infant bends from standing position to pick up motivating object on floor.	Provide opportunities for practice with caregiver. Totally blind infants should first be encouraged to locate relatively large objects in contact with their feet that are easy to pick up such as a long string of popbeads, a light piece of clothing, or a favorite soft toy.

Gross Motor Development

Process: Locomotion

CLUSTER	BEHAVIOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 2	Moves forward using prewalking methods	Bayley 1&2 Norris et al.	When placed on stomach on flat surface, infant can move 9 inches in any direction on hands and feet, by crawling, creeping, in sitting position, or any other method.	Infants need motivation to move. Encourage the infant to move toward caregiver or favorite toy within arm's reach, then further away. Infants with usable vision can be encouraged to move toward a toy with attractive, but not overwhelming lights to increase perceptual cues. If necessary, dim room lights at first. Make certain the toys used are ones that the infant enjoys.
Cluster 3	Attempts to walk	Bayley 1&2 Fraiberg	While holding adult's hands for support and facing adult, infant can make stepping movements in an attempt to walk.	Encourage practice during active play with caregiver. Based on early experiences moving in different positions and weight bearing while standing. Remember that the infant needs to move toward a desired object or person. For sound-making objects to attract infants with no usable vision from a distance, the infants must understand that an object exists based upon sound cue alone. When first learning to walk toward sound-making objects, the sound source should be kept stationary.
	Creeps forward on hands and knees 3 feet or more	VIIRC	Infant moves on hands and knees at least 3 feet.	Infants need motivation to move. Encourage the infant to move toward caregiver or favorite toy within arm's reach, then further away. Infants with usable vision can be encouraged to move toward a toy with attractive, but not overwhelming lights to increase perceptual cues. If necessary, dim room lights at first. Make certain the toys used are ones that the infant enjoys.

Gross Motor Development

Process: Locomotion [Continued]

CLUSTER	BEHAVIOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 3	Walks forward with help	Bayley 1&2 Norris et al.	Infant takes coordinated walking steps, holding on to furniture or an adult with one hand for support.	Encourage practice during interactive play with caregiver. For example, the caregiver can walk backwards slowly, while the infant holds the caregiver's legs for assistance.
Cluster 4	Walks sideways holding on to furniture	Bayley 1&2 Brambring Norris et al.	Infant can walk sideways or backwards while holding on to wall, furniture, or a pull toy.	Encourage infant to practice these skills to reach a caregiver, sibling, or a favorite toy.
	Walks alone	Bayley 1&2 Brambring Fraiberg Norris et al.	Infant can take at least three steps without assistance or support.	Encourage practice during interactive play with caregiver. Caregiver should attract infant's attention, acting as lure. A favored toy can also be used. Remember, for sound-making toys to attract infants with no usable vision from a distance, the infants must understand that an object exists based upon sound cue alone.
	Walks alone with good coordination	Bayley 2 Brambring Fraiberg Norris et al. VIIRC	Without support, infant can take at least five steps independently with good coordination and balance.	Encourage practice during interactive play with caregiver. Caregiver should attract infant's attention, acting as a lure. A favored toy can also be used. Remember, for sound-making toys to attract infants with no usable vision from a distance, the infant must understand that an object exists based upon sound cue alone.
	Overcomes simple obstacles	Norris et al.	Infant pushes away small objects such as chairs or backs up mobility toy when runs into large objects.	Infant learns to move through larger space through practice via trial and error. Once the infant is mobile, objects need not always be moved to clear a path so the infant has the opportunity to learn to move them or go around them.

Gross Motor Development

Process: Locomotion [Continued]

CLUSTER	BEHAVIOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 4	Goes about house or yard	Norris et al.	Independent of other people, infant can go about familiar house or yard alone, by crawling, walking, or other means. Infant may hold on to wall or other objects.	Independent exploration is an important skill for visually impaired infants. Exploring first takes place in familiar surroundings so that the infant (and caregivers) are not fearful of exploration in unfamiliar surroundings. Auditory and tactile markers can be used by some infants to identify locations such as a small carpet in front of the bathroom door, wind chimes at the back door.
Cluster 5	Moves around barrier	Brambring Carolina Koontz	Infant can move around barrier such as furniture or a toy using any form of locomotion including creeping, walking, etc.	Often, infants with visual impairment push their way through barriers, rather than moving around them. Infants must be aware that there is something on the other side of the barrier, where that object is in space, and how to find a path around the barrier. Simple peek-a-boo games, then simple hide-and-seek games with a caregiver can encourage the cognitive prerequisites for this skill (e.g., knowing that an object exists when hidden by another object, understanding an object's location in space).
	Walks up stairs with help.	Bayley 1&2 Norris et al VIIRC	Infant can walk up two or more stairs holding wall or rail for support.	Provide opportunities for practice with caregiver for assistance. May want to start with one step. Favored toy can be at top step as a reward. Practice on curbs, assisting infant. Allowing the child to crawl up and down the stairs with appropriate supervision will help familiarize the infant with the layout of the stairs so that the infant has a concept of them.
	Walks down stairs with help.	Bayley 1&2 VIIRC	Infant can walk down two or more stairs holding wall or rail for support.	Provide opportunities for practice with caregiver for assistance. May want to start with one step. Favored toy can be at the bottom step as a reward. Practice on curbs, assisting infant. Allowing the child to crawl up and down the stairs with appropriate supervision will help familiarize the infant with the layout of the stairs so that the infant has a concept of them.

Gross Motor Development

SOURCE	POPULATION	TYPE
Bayley 1	normally sighted infants	standardized infant development scale
Bayley 2	normally sighted infants	standardized infant development scale
Brambring	infants who are totally blind or have light perception, includes premature infants and infants with multiple disabilities	research study
Carolina	infants with disabilities	literature review for assessment items
Fraiberg	infants who are totally blind or have light perception only; no other disabilities	research and clinical observation
Koontz	normally sighted infants	standardized infant development scale
Norris, et al.	infants who are totally blind, visually impaired; includes premature infants corrected for prematurity	research study
VIIRC	infants who are totally blind, visually impaired; includes premature infants; multiple disability data available but not included here.	research study

FUNCTIONAL VISION DEVELOPMENT

Functional Vision Development

Description

This functional vision section addresses the development and use of vision for purposeful behavior.

Explanation

Most children with visual impairment have some degree of vision (O'Donnell & Livingston, 1991), and any amount of vision if appropriately encouraged can serve to promote cognitive, motor, social, and communicative competence (Warren, 1994). The effectiveness of visual habilitation programs to promote the use of limited vision in older children was initially demonstrated through the ground breaking work of Natalie Barraga (1964). The earlier the vision loss is detected, the sooner it can be addressed in an intervention program to promote vision development and use (Morse & Trief, 1985). In infancy, it is more likely that children with more severe visual impairments will be identified. Many vision deficits in early childhood remain undetected since vision screening and subsequent referral for infants and preschool-age children is not universal (Trief & Morse, 1987). Since the probability that children with developmental problems will have visual deficits is high (Erhardt, 1988; Travernier, 1993), it is critical that infants with any type of developmental abnormality receive a vision examination to rule out mild, moderate, or severe visual impairment.

Visual Capacities

Visual capacities and behaviors discussed in this section are as follows:

Visual Detection	The infant *notices* that a visual stimulus is present.
Fixation	The infant *directs the eyes* to attend to a visual stimulus.
Visual Discrimination	The infant *discerns differences* among visual stimuli
Saccadic Eye Movements	The infant *makes fast, voluntary eye movements* as when changing fixation from one object to another.

Pursuit Eye Movements	The infant *visually follows* a moving target.
Convergence	When the infant *directs both eyes to an object at close range*, the eyes turn inward so that both maintain fixation on the object of regard.
Accommodation	When the infant *directs visual attention to objects at different distances*, the objects are kept in clearest focus through involuntary adjustments of the crystalline lens within the eye.
Stereopsis	The infant perceives the relative distance of objects based upon differences in the images received by each eye that result from spatial displacement thus giving *depth perception.* Stereopsis acts as a fine-tuning mechanism, providing very refined depth perception information. (Other factors that provide information about depth include overlap, perspective, shadow distribution, and motion cues.)
Binocularity	The infant uses both eyes simultaneously resulting in a *fusion of two images into a single perception.*

Complex Visual Behaviors

Visual Attending Behaviors	The infant *visually attends* to environmental stimuli. These behaviors have a major visual component, require basic visual capacities, and promote "learning to look" (Rogow, Hass, & Humphries, 1984).
Visual Examining Behaviors	The infant *makes cognitive judgments* based upon visual input. These behaviors have a major visual-cognitive component, require basic visual attending behaviors, and promote "looking to learn" (Rogow et al., 1984).
Visually Guided Motor Behaviors	The infant *makes fine or gross motor adjustments* based upon visual input. These behaviors have a major visual-motor component, require visual attending behaviors, and may require visual examining behaviors.

(adapted from Hall & Bailey, 1989)

Infants with visual impairment must be involved in experiences that promote the development of basic sensory and motor capacities of the visual system. These infants may not see well enough for these basic visual capacities to develop fully in naturally occurring environments (Sonksen, Petrie, & Drew, 1991). Special methods may be required to attract and maintain the visual attention of these children in visual habilitation programs, transitioning later to more naturally occurring stimuli whenever possible (Glass, 1993). The methods used will vary according to the specific needs and visual abilities of individual infants.

Infants with visual impairment must also learn to apply their vision so that they can perform cognitive and motor tasks adequately. While these children may be able to learn to use their vision well, many children with visual impairment who have usable vision have difficulty in later years with spatial concepts, verbal comprehension, social adaptation, and exploration of the environment (O'Donnell & Livingston, 1991). This has been attributed, in part, to the lack of training in methods which compensate for decreased environmental information (Corn & Bishop, 1984).

The overall goal of early intervention is to promote the effective and efficient use of vision in usual activities of daily life with appropriate visual adaptations and sensory substitutions as necessary. Several overlapping approaches are needed to accomplish this:

1. **Promoting the optimal development of the infant's visual system by providing opportunities for vision use.** This is accomplished by devising methods that maximize the infant's ability to extract and use visual information from the environment.

2. **Encouraging the infant to apply limited vision to problem-solving tasks.** This is accomplished through appropriate preparation of the infant's visual surroundings and by developing structured visual tasks that promote specific problem-solving skills involving vision.

3. **Providing specific training and techniques that help infants with visual impairment verify and supplement their limited visual input.** This is accomplished by providing corroborating tactual, kinesthetic, auditory, and olfactory input as appropriate, assisting the infant in the integration of input from various senses, and by providing meaningful verbal feedback about objects, their properties, and environmental events.

Intervention Concerns

Every young child with substantially reduced vision should be in some type of program that promotes vision functioning. The type of program depends upon the child's developmental level, visual capacities, and visual behaviors (Hall & Bailey, 1989). Early introduction of vision habilitation encourages use of the visual system during its most critical period of growth and

fosters the application of visual skills to all other aspects of development and learning (Sonksen et al., 1991). Assistance from teachers certified in the area of visual impairment and familiar with the developmental needs of infants is strongly recommended.

- Prior to any intervention, it is necessary to obtain **information about the infant's visual capabilities** and how these abilities are used. Without this information, appropriate intervention strategies cannot be designed. This information can also be extremely helpful to caregivers who can easily overestimate or underestimate their young child's visual abilities. Many very young infants with visual impairment are first thought to be totally blind, but a large percentage eventually develop some useful sight. The greatest development in visual functioning is noted in the first 18 months of life (Jan, Farrell, Wong, & McCormick, 1986). Infants who experience widespread maturational delay of cortical function, for example, may appear to be severely visually impaired in early infancy, but may develop normal visual capabilities (Hoyt, Jastrzebski, & Marg, 1983).

  Considerations: A number of techniques are available to assess visual capabilities in infants. Ideally, once the initial medical diagnosis of vision loss is determined and the child is referred for intervention services, the educational specialist and the eye doctor will work in harmony along with the infant's caregivers to determine a child's level of visual functioning. Some assessment methods involve informal observation with objects, direct testing with various patterns, symbols, or objects, or electrodiagnostic testing to determine the infant's ability to respond to details. An evaluation of vision can include an examination for ocular health, ocular motility (eye movement capability), refractive error (need for spectacle correction), visual fields (area of vision), contrast sensitivity (ability to detect subtle shades of gray), and color vision. Use of vision in daily tasks must also be examined to determine whether or not there is a discrepancy between assessed degree of vision and actual visual use. For further information see: Bailey, 1994; Barraga & Morris, 1980; Blanksby, 1994; Costello, Pinkney, & Scheffers, 1980; Hall, Orel-Bixler, & Haegerstrom-Portnoy, 1991; Hyvarinen, 1995; Hyvarinen & Appleby, 1996; Langley & DuBose, 1976; Sonksen, 1982.

- When working with infants with visual impairment, it is critical to determine their potential and preferred **region of visual attention** (Hyvarinen & Appleby, 1996). The region of vision attention can be divided into preferred proximity and preferred direction of gaze (I. Bailey, personal communication, December 28, 1995). This region can be determined by obtaining information concerning peripheral visual fields (area of side vision), degree of remaining vision for seeing at longer distances (distance visual acuity), ability to see at near (accommodation and near visual acuity), developmental level, other visual difficulties that may be present such as central scotomas (i.e., blind spots), nystagmus, and oculomotor palsies which can affect head and/or eye movements to fixate and maintain fixation. Assistance from an eye care specialist to determine the need for any optical correction for refractive error or accommodation is critical.

Considerations: Materials must be presented in the preferred region of visual attention for optimum learning, and efforts must be made to encourage the child to view events in the potential region of visual attention. Although research evidence for infants with visual impairment is minimal, it is believed that through training, the preferred region of visual attention can be increased to match the potential region. The potential region of visual attention enlarges with maturation in normal infants. Certainly, the potential region of visual attention can be increased when an optical correction is provided to correct for refractive error (i.e., nearsightedness, farsightedness, astigmatism) or when an optical correction is provided to compensate for lack of ability to accommodate for near viewing (i.e., provision of "reading" glasses) (Hyvarinen, 1988). The latter must be determined from an examination by an optometrist or ophthalmologist.

- While certain patterned stimuli may rivet a child's attention in early infancy, the **human face** is considered to be the most appropriate stimulus to promote visual development (Glass, 1993; Morse, 1991). Jan and his colleagues (1986) found that fixation, overall, was better with a human face than a light source for many infants with visual impairment whose development was followed over time. It cannot be stressed enough that early learning through caregiver-child interactions promotes and strengthens growth in all developmental domains including vision functioning. It must be recognized, however, that some severely visually impaired infants will not have sufficient vision to respond to a human face. More conspicuous visual input must be used with such children.

  Considerations: Caregivers may need to move their faces closer to infants with visual loss (Sonksen, 1983). For infants with field loss or difficulties with central fixation, the optimum position for viewing the face must be determined, and adjustments made accordingly. Lipstick can increase the contrast of the lips which may help some children attend to a mother's face. Some children with severe vision loss cannot see well enough to discriminate facial features, even at a close range. Children with cortical visual impairment often do not attend to faces (Steendam, 1989), necessitating the use of other stimuli to attract and maintain their attention.

- Children with visual impairment may need **encouragement to look at their hands**. This provides practice for the development of many visual capacities such as detection, fixation, discrimination, and convergence leading to the more complex visually guided motor behavior of reaching (Hyvarinen, 1988).

  Considerations: Children should be encouraged to look at their hands through special positioning (Glass, 1993). If hand regard is absent, Hyvarinen (1994) recommends bringing the infant's hands to midline and pressing the palms together while talking gently in order to encourage a brief eye-hand contact. Sonksen (1983) suggests placing the infant's hand on the caregiver's cheek as the caregiver leans over to talk to the infant and patting the hands together in play. She also recommends similar

play with feet at a later age. Placing half-mittens of varying textures on the infant's hands sometimes with objects attached or placing the child's hands on a light box to heighten contrast has also been recommended (Hyvarinen, 1994). Cloth or other safe, highly visible "bracelets" can be placed around the infant's wrists as well.

- **Methods that encourage infants with visual impairment to attend to objects** in their environment are especially critical for very young infants with visual impairment since visual fixation shortly after the neonatal period has been associated with print reading ability at school-age (Jan et al., 1986). Infants with visual impairment often require stimulus modifications so that they can visually detect and examine objects and details within objects, but care must be taken in designing appropriate modifications depending upon task goals, children's visual abilities, and children's behavioral states at the time of instruction. If the level of stimulation is too high or too many features are highlighted, the child may be distracted and go from one conspicuous feature to another without extracting meaning from the experience. The infant may persist in visual fixation rather than task performance, staring rather than doing or thinking. Additionally there is the possibility that the child may have difficulty with a visually cluttered environment and avoid a task entirely (a common behavior in children with cortical visual impairment) since children differ in the amount of sensory information they can manage (Morse, 1991).

  Considerations: Methods to attract and maintain attention include:

  a. Providing more conspicuous stimuli to attract the infant's attention such as high contrast, large size, use of color cues, use of reflective objects such as foil, highlighting a specific feature of an object through contrast, color, patterns, or illumination (Blanksby, 1994; Levack, 1991).

  b. Reducing distractions from competing visual or other sensory stimuli by using simple patterns or lines, placing objects against a simple background, presenting one object at a time or stimuli that are widely spaced within the infant's field of attention, working in a quiet room, using illuminated objects in dimly-lit rooms, limiting talk to key verbal feedback as needed during vision habilitation sessions (Levack, 1991; Morse, 1991).

  c. Attracting the child's attention to specific objects or object features through non-visual means (e.g., use of verbal description, tapping near the object, the addition of textural cues).

- The use of consistent, repetitive, and meaningless visual or auditory stimuli as sensory stimulation interventions (e.g., continuous presentation of black and white patterns, lights, pompoms, repeating sound toys, music) lead to **habituation**. Typically, infants learn to

ignore (habituate to) irrelevant environmental stimuli so that they can maintain an alert state and attend to relevant information. No learning occurs when infants with visual impairment become habituated to repetitive, meaningless stimuli and are without access to other, more meaningful stimuli that promote interest and interaction.

Considerations: If a baby is neurologically vulnerable, is prone to startling, or does not habituate easily, then the environment should be modulated and quiet, with structured and systematic presentation of meaningful stimuli (e.g., infant's bottle, favorite toy, caregiver's face, caregiver's voice) in order to get the infant to focus attention on relevant information and habituate to irrelevant and distracting environmental stimuli.

- **Coordinating information obtained through different modalities** is crucial for infants with decreased visual abilities. It is important to stimulate all the sensory systems of infants with low vision. This will make them aware of sensory input, teach them ways to learn about their environment using different modalities, and encourage growth using sense modalities that play a key role at different developmental stages. Premature and very young infants will initially require intensive stimulation involving the tactile-vestibular system which is more developed at birth than the auditory and visual systems. These infants will build upon and integrate information and behaviors learned this way with other systems as maturation occurs (Glass, 1993). It has been postulated that spatial localization skills must be encouraged through the use of auditory cues in infants with visual impairment before three months of age since visual-auditory cues are first involved in spatial mapping followed only later by integration with tactile information. Tactile information may tend to keep the infant oriented to exploratory experiences with objects (mouthing, grasping, manipulating) rather than fostering the investigation and mapping of objects in space until purposive actions with objects occur (Schwartz, 1984).

  Considerations: Reaching based upon tactile cues must be coupled to reaching with sound cues for infants with vision loss. Bringing an infant's hand to a sound-making object rather than an object to the infant is considered critical in promoting spatial understanding (Sonksen, Levitt, & Kitsinger, 1984).

- With respect to premature infants, Glass (1993) stresses that an infant's ability to respond to a strong level of stimulation does not necessarily mean that stimulation should always be at that heightened level. This principle also applies to infants with visual impairment. Although infants attend more readily to black-and-white stimuli than to pastel stimuli, this does not mean that infants do not see pastel. **Levels of stimulation should be varied** to familiarize infants with usual environmental conditions since the infants must operate in those conditions in addition to providing heightened stimuli to train specific visual behaviors. In other words, infants live in a world that encompasses a variety of visual cues from very subtle to more pronounced. They must learn to operate as effectively as possible with all types of visual stimuli. Variety should be incorporated into a vision habilitation program for

most infants with visual impairment. Items should be made more conspicuous for specific visual habilitation tasks, for ease of location of particular objects, and to increase motivation in play and learning tasks. Children also need to learn effective strategies when they encounter less pronounced visual stimuli which may involve the use of other senses.

Considerations: While infants with visual impairment may require enhanced stimuli to attract their attention (Blanksby, 1994) if they do not initially attend to a face, a toy, or their hands, etc., a transition should be made to more normal stimuli under more natural conditions as soon as possible (Glass, 1993). Glass (1993) makes some recommendations for newborn, premature infants when there is a need to substitute inanimate forms for the human face. Some adjustments for infants with visual impairment have been added:

a. Use soft-to-the-touch, simple forms. Infants with visual impairment may require simple, high contrast forms against a contrasting background.

b. Provide 3-dimensional objects rather than high contrast designs when possible. This is particularly important for infants with cortical visual impairment.

c. Involve slow, continuous movement.

d. Vary the stimuli depending on the intent to soothe or arouse.

e. Allow for selective attention. A mobile, for example, should be hung slightly off-center and closer to the stomach than the face and at least 2 feet away so that the child can choose to look at it or not. For infants with decreased visual acuity, the mobile can be hung closer than 2 feet with adult supervision for safety. The distance and location will depend upon the extent and type of vision loss.

- Research with toddlers and preschoolers with multiple disabilities has shown that visual stimulation that is contingent (i.e., dependent) upon the child's behavior increases visual attention (Goetz & Gee, 1987; Utley, Duncan, Strain, & Scanlon, 1983). For example, an infant touches a switch which causes a toy to light up, engaging the attention of the infant. Noncontingent stimulation, on the other hand, is independent of the infant's behavior. For example, a shiny pompom is shaken in front of an infant to attract the child's visual attention. Vision habilitation techniques have also been characterized as passive vision stimulation and active vision stimulation depending upon the child's role in the process as an active participant or a passive onlooker. Noncontingent visual stimulation activities may be needed to engage the attention of infants with severe multiple disabilities. However, once visual attention to an object is elicited, habituation to the stimulus occurs. The infant will lose interest in the task unless the object of attention is changed, the object is moved, or the infant is motivated to interact with the object in some way. The type of activity needed to promote active learning will depend upon the infant's visual capabilities and developmental level. For every infant, **lessons involving noncontingent stimuli should be**

extended to encourage infants to touch, manipulate, recognize, or to indicate preference once they learn to fixate on a particular visual stimulus whenever possible. Extending the earlier example, when the infant shows interest in the shiny pompom, the length of time for attending to the pompom can be gradually increased by slowly shaking or moving the object slightly, and the infant can be encouraged to touch the pompom as it is shaken. **The goal of a visual stimulation program must be to promote interaction with the environment through visual examining and visually guided motor behaviors** (Hall & Bailey, 1989).

Considerations: Develop contingent stimulation activities for infants. For example, when an infant looks towards a toy monkey, it then dances, clangs, and lights up. This spectacle is activated when the infant is looking at it so that the infant learns that looking at that toy makes something happen.

- In developing interventions to promote the functional use of vision, the first priority should be to **identify where, when, and how the infant might be encouraged to look.**

Considerations: First, identify natural situations that motivate the infant's visual attention (e.g., mealtime for an infant who likes food, play time for an infant who likes to play, and so on). Next, consider adaptations that need to be made to enhance the visibility of the target object (e.g., the use of contrast, color, size, or distance).

- **Developmental differences in adaptive behaviors** of infants with severe vision loss due to specific vision deficits have not been widely documented. Hyvarinen (1994) has noticed that infants with binocular vision appear to use a curved motion when reaching for objects at midline, while many infants with monocular vision bring a hand in from the side to midline near the body, then reach straight ahead. She postulates that the absence of depth perception based on binocularity, and the reliance upon monocular cues for depth lead to different reaching strategies. Sonksen (1982) indicates that when vision is virtually absent in one eye and limited in the other, it leads to unbalanced integration of auditory input from each ear resulting in unequal ability to locate sound to each side. She also notes that unequal integration may also lead to unequal postural reactions. There may be other behavioral differences for infants with severe vision loss, and these differences may vary with the degree and quality of the loss.

Considerations: It is critical to understand how a particular child's vision loss affects functioning in order to determine whether a "different" behavior is adaptive or maladaptive for that child. Since the population of children with severe vision loss is so heterogeneous in nature, this must be determined on an individual basis.

- Some unusual visual behaviors may be observed in infants with visual impairment who have some usable vision. **Neurobehavioral adaptations to diminished vision** can compensate for a visual disability (Good & Hoyt, 1989). Some behaviors should eventually be discouraged such as eye-pressing and light gazing, while many are likely to have a continuing adaptive function such as unusual gaze behaviors involving the head and/or eyes

or bringing materials unusually close to the eyes. As mentioned in the chapter, Visual Impairment in Infants, early interventionists must work together with medical specialists to explain the biological causes and behavioral relevance of these behaviors to caregivers and staff working with infants with vision loss (Good & Hoyt, 1989). They must also work with medical specialists to identify those behaviors that are perseverative, and have no long-term adaptive function.

Considerations:

Perseverative Behaviors — *Consultation with medical specialists is necessary to determine when to redirect the infant from these behaviors since they may initially have adaptive value (Good & Hoyt, 1989).*

a. Eye-poking is socially unacceptable and can lead to permanent disfigurement with sunken orbits (Jan, Freeman, & Scott, 1977), although it must provide some sort of positive reinforcement since children choose to repeat this behavior (Warren, 1984). It can be discouraged through the use of protective glasses over the eyes and by encouraging the development of manual activities that are more motivating for the infant (Hyvarinen, 1988, 1994).

b. Persistent staring at light sources can become maladaptive for infants with severe vision loss (Jan et al., 1977). Effort should be made to interest the infants in other sources of visual input and/or other sensory input that promote active engagement through exploration.

c. Persistent hand-flicking in front of the eyes is another behavior that can become perseverative. Encouraging involvement in activities that promote exploration and cognitive growth is again advised.

Adaptive Behaviors

a. Infants with visual impairment may have unusual gaze behaviors involving the position of the eyes and/or head that serve to promote better vision by reducing nystagmus (usually rapid, involuntary eye movements that can be up and down, side-to-side, and/or rotary) or which focus the visual image on undamaged portions of the retina (eccentric fixation).

b. Infants with visual impairment may hold material unusually close to the eyes in order to bring it into best focus, look at an enlarged image for distance magnification, and/or look at an enlarged image to reduce distracting visual input (often seen in children with cortical visual impairment).

- In preparing the environment for infants with reduced vision, care should be taken to optimize general environmental conditions under which an infant must operate as well as the visual components of specific training tasks (Hall & Bailey, 1989). Under many circumstances, stimuli will be made more conspicuous, especially for children with profoundly reduced vision who will also require concomitant input from other sense

modalities. Once a visual task is mastered, the strength of the visual stimulus might be gradually reduced to more closely simulate normal conditions, depending upon the infant's degree of visual impairment and developmental level. Therefore, **careful, continuing choices must be made concerning appropriate visual stimuli** including task size, position, lighting, contrast, color, and duration as the infant progresses in all developmental domains (Hall, 1990). For example, an infant may be learning to eat from a red or yellow plastic spoon in order to encourage the child to fixate and follow as the spoon is moved from the plate to the infant's mouth. When the infant consistently follows this movement, the caregiver might change to a more usual metallic gray spoon to encourage the infant to follow this less conspicuous stimulus.

Considerations: There are some general guidelines for the provision of visual adaptations and/or sensory substitutions for visually impaired children with remaining vision, and they are summarized here:

Size

a. In general, if an infant cannot see the details of a vision task, task size can be increased unless the infant has a major field loss.

b. During training, the size might be gradually reduced to determine the minimum size needed for that infant to perform the specific task without difficulty.

c. Infants can be repositioned closer to visual stimuli or stimuli can be brought closer to the infants to increase relative size.

d. In usual activities, it is important to have objects or object details 3 to 5 times larger than the minimum size required to elicit a minimal response (threshold) or to bring the object 1/3 to 1/5 closer than the "threshold detection" distance if the infant can focus at that distance (I. Bailey, personal communication, December 28, 1995).

Position

a. Objects for exploration should be placed in the infant's preferred region of attention (Hyvarinen & Appleby, 1996). During training, tasks might be placed in the infant's potential region of attention as determined by visual assessment to promote expansion to that visual region. Hyvarinen (1988) recommends that family members wear visually distinctive items to identify themselves that encourage recognition by older infants at a distance (e.g., a scarf, eyeglasses, etc.).

b. For some very nearsighted children, eyeglasses might be necessary for looking at things beyond arm's reach, but sometimes it might be helpful for them to remove their eyeglasses when they look at things at very close distances. Children with *uncorrected* farsightedness or reduced accommodation might have more difficulty

focusing on objects held at extremely close range. Information regarding these influences on preferred proximity can be provided by the infant's ophthalmologist or optometrist along with recommendations for optical corrections for any refractive errors or reduced accommodation.

c. For infants with reduced visual field due to damage to the visual system, the infants should be positioned such that materials for regard are available for viewing in the intact visual field.

d. Bringing an object to a very close distance can have different effects for children with differing eye conditions. These differences must be taken into account when determining optimal object viewing distance. According to Bailey (I. Bailey, personal communication, December 28, 1995), moving an object closer to an infant's face can cause it to dominate the visual field. For some children, this may be helpful since it blocks potential sources of distraction or confines the distractions to more peripheral regions of the visual field. Other children might find this technique unnecessary or even uncomfortable. For children with large central scotomas, bringing objects into close range can sometimes reduce the functional impact of the scotomas. On the other hand, for infants with constricted visual field, an object held at very close range can sharply reduce the amount of information about the object as a whole since only a small part of it can be discerned. A closer viewing distance means that it is easier to see an object's component parts but harder to see the whole object. It might require excessively large eye movements and perhaps even head movements to shift attention from one feature to another. Watching a 35-inch television screen from 1-inch away illustrates this issue (I. Bailey, personal communication, December 28, 1995). This is also an important point to remember for infants with oculomotor limitations.

e. Young infants may require special positioning to promote hand regard (Glass, 1993). Some infants with visual impairment may require special positioning in general to promote optimum visual performance.

f. Some infants may have motor impairments that limit the movement of their head and/or eyes. This must be taken into account when positioning the infants for visual tasks so that infants can more easily fixate and follow.

g. Materials should be positioned appropriately for infants who require adaptive, alternative gaze strategies that reduce the amplitude of nystagmus or maintain optimal fixation patterns.

h. Gaze stabilization is critical to the visual control of action (Daniel & Lee, 1990). Infants with visual impairment who experience difficulty maintaining head control due to additional physical impairments may require special positioning to facilitate optimum head and eye movements. Input from a physical therapist can be extremely helpful here.

Lighting

a. Newborn infants are sensitive to bright light and open their eyes for longer durations in subdued lighting. Glass (1993) suggests that low illumination levels initially facilitate visual attention. Infants with visual impairment may have visual conditions that alter usual lighting requirements, but it is important to remember that bombarding the infants with additional, very bright light might, in many instances, impede their performance.

b. Encouraging unusually prolonged fixation to bright or flashing lights does not promote visual attending, visual examining, or visually guided motor behaviors and may not promote development (Sonksen et al., 1991).

c. Some infants with visual impairment may be highly sensitive to light beyond early infancy and require reduced illumination, while others may require increased illumination for optimal vision functioning. This must be determined through medical and functional vision evaluations so that appropriate levels of illumination can be provided to maximize the use of vision during infancy.

d. Effort should be made to reduce glare in the environment for all infants with visual impairment.

e. Infants who squint or who shield their eyes in bright sunlight may require some sort of filter to reduce incoming sunlight (sunglasses), a hat with a visor, and/or a cover over their stroller.

f. Placement of infants so that bright light sources shine directly into their eyes (e.g., from ceiling lights, table lamps, or windows) should be discouraged. This can often occur in institutional settings where bright ceiling lights are common and infants with visual impairment are placed on their backs under them. Particular attention must be paid to the general positioning of infants with visual impairment who are photophobic (extremely sensitive and uncomfortable in bright light).

g. When an infant appears disoriented or disturbed when moving from bright to dim light or from dim to bright light, the infant should be given a longer time to adapt to the lighting changes. Special vision testing may be required to determine the underlying visual cause of this behavior.

h. The use of task lighting such as table lamps with directed light or flashlights in dimly lit rooms can help to focus an infant's attention to certain tasks. It is recommended that exercises such as these be considered for training purposes only, and that, when possible, infants be provided training designed to gradually elicit the targeted skills under normal lighting conditions whenever possible.

i. Presenting objects or placing an infant's hands on a light box can serve to focus attention or heighten contrast. It is recommended that exercises such as these be considered for training purposes only, and that infants be provided training designed to gradually elicit target skills which more closely resemble normal daily activities and/or play patterns occurring under normal lighting conditions.

Color

a. Color vision mechanisms are probably functioning from birth or shortly there-after, but colors must be very saturated (vivid) and targets must be fairly large for young infants to manifest a behavioral response due to overall low sensitivity of these mechanisms (Allen, Banks, & Norcia, 1993; G. Haegerstom-Portnoy, personal communication, February 1, 1996; Volbrecht & Werner, 1987).

b. Development of color perception by infants with vision loss may vary depending upon the cause of their visual impairment.

c. Many individuals with reduced vision have color perception problems. In general, it is best to use bold, primary colors (red, orange, yellow, green, blue, violet) or white or black for infants with visual impairment.

d. All visual stimuli are good for the developing visual system of young infants and they should be exposed to colors that are not saturated even though they may not show particular interest in them (G. Haegerstrom-Portnoy, personal communication, February 1, 1996). The use of subtler shades should be considered for incorporation into intervention programs for these infants for general exposure and as part of specific training protocols (for example, when a goal is for the infants to respond to less visually conspicuous objects).

e. Some children may have color preferences. These should be incorporated into intervention tasks (Sonksen, 1982).

Contrast

The ability to distinguish subtle differences in contrast is important for distinguishing facial features and for mobility and search tasks (Bailey, 1994). An infant's ability to work with low contrast materials can be determined through observation and testing (Hall et al., 1991). As a general rule, it is best to provide higher contrast materials for infants with visual impairment, especially in the first months of life. In addition, objects may require presentation against a high contrast background to facilitate ease of viewing. Incorporation of low contrast conditions for general exposure and as a part of specific training protocols leading to increased use of low contrast materials should be considered when appropriate.

Duration

a. Infants with visual impairment may tire or lose interest more readily in tasks that require fine visual discriminations. If the infant tires quickly because a task is visually tedious or the task can be completed more efficiently and effeetively with visual adaptations and/or sensory substitutions, these alternatives should be considered.

b. Infants with visual impairment may take a longer time to respond to visual events around them, especially those who have additional disabilities involving motor limitations or sensory integration difficulties. It is important to allow sufficient time for infants to respond to any sensory stimuli.

- **Cortical visual impairment** is caused by damage to the visual eortex, to the posterior visual pathways, or both, and can be present with ocular visual impairment (Groenveld, Jan, & Leader, 1990). It is mentioned here since intervention methods for this group of children differ from those with ocular visual loss. These children differ in the way in which they process visual input, leading to problems in the interpretation of visual information (Groenveld et al., 1990). Although intensive investigation of this group of children has begun only recently, what is known concerning behavioral characteristics and appropriate habilitation methods has been outlined extensively (Groenveld et al., 1990; Jan & Groenveld, 1993; Jan, Groenveld, Sykanda, & Hoyt, 1987; Levack, 1991; Morse, 1990).

Considerations:

a. Steendam (1989, pp. 16-23) has summarized characteristics of children with cortical visual impairment. Most children do not manifest all characteristics listed: a) variability in visual functioning, b) visual inattention and lack of visual curiosity, c) better functioning with familiar objects or surroundings, d) looking away when reaching, e) figure background discrimination difficulties, f) easier color than shape recognition, g) better detection of moving than stationary objects, h) inability to recognize faces, i) problems with depth perception, j) difficulty compensating for field loss when other brain damage is presenl, and k) good mobility skills.

b. Levack (1991, pp.16-17) has summarized possible methods to consider when working with children with cortical visual impairment: a) use other sensory cues to stimulate or support visual information, b) avoid visual overstimulation, c) use one sense at a time when other sensory cues are used to stimulate visual attention, d) watch for preference in color, shape, size, movement, and field, e) make changes gradually since information processing is a problem for these children, f) shake or move objects as they are brought into the child's field of vision, g) use the best positioning for viewing so that children are not putting energy into maintaining a difficult physical posture while completing a visual task, h) consistently use bold, simple visual cues, avoid visual clutter, and maintain high contrast.

Opportunities for Learning

Opportunities that promote vision functioning include:

- Encouraging the use of corrective lenses for refractive error or for lack of accommodation in early infancy as determined by an ophthalmologist or optometrist, preferably one who specializes in infants with visual impairment.
- Promoting optimal development of the infant's visual system by providing opportunities for vision use, including the selection of appropriate visual modification and/or sensory substitutions for different purposes.
- Encouraging the infant to apply limited vision for problem-solving tasks.
- Encouraging the infant to use and integrate information from all sensory modalities.
- Providing meaningful verbal feedback to the infant about objects, their properties, and environmental events.

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Functional Vision Development Charts

The development of skills and behaviors related to vision functioning in visually impaired infants has been examined in terms of three processes. Indicators for these processes are listed in the corresponding charts that follow. The charts can be used to help determine critical skills and behaviors to consider for intervention with individual infants.

For each process, determine the developmental cluster for an infant by identifying the skills and behaviors that an infant has attained. Then use the skills and behaviors within that developmental cluster or at the next developmental cluster as guides when devising an intervention program for the child. (Note: Some infants may have skills and behaviors in more than one cluster in a developmental process.)

Process **Visual Attending Behaviors**

The infant visually attends to environmental stimuli.

Process **Visual Examining Behaviors**

The infant makes cognitive judgments based upon visual input.

Process **Visually Guided Motor Behaviors**

The infant makes fine or gross motor adjustments based upon visual input.

Note: Infants must have vision sufficient to participate in the activities on these charts.

Functional Vision Development

Process: Visual Attending Behaviors

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Regards person momentarily *(Infants with cortical visual impairment may not regard a face but may regard a moving object.)*	Bayley 1&2	While holding infant about 1 foot from face, infant regards adult. Talk to attract infant's attention.	Encourage infant to look at the faces of caregivers. Bring the caregiver's face closer if necessary. Place the infant's hand on caregiver's face. Women can wear lipstick to heighten contrast. Caregiver can wear a shirt of contrasting color to highlight the face.
	Inspects surroundings	Bayley 1&2 Glass	Infant turns eyes or head in visual exploration of surroundings.	Provide simple, bold objects for visually impaired infant to watch. A uniform background of contrasting color is recommended for ease of viewing. Some infants will not require visual enhancement to encourage viewing. Some may require bolder, bigger stimuli at a closer distance. Others may require presentation of *softly* illuminated objects in dimly lit rooms or objects spotlighted under *soft* illumination in dimly lit rooms. This will depend upon the infant's vision capabilities and the training objective.
	Eyes follow moving person	Bayley 1&2	While lying on floor on back, infant's eyes follow a person moving within visual field.	Encourage the infant with gentle vocalizations and tactual stimulation.
	Regards object very briefly	Bayley 1&2	Stand behind infant and outside field of vision. Suspend toy or ring so that the lower edge is at midline and 8 inches above infant's eyes. Move toy, then hold it stationary. Infant gazes at toy at least 3 seconds in one of three trials. *(May need closer distance for infants with visual impairment.)*	Present objects to the infant during interactive play that the infant can see. For severely visually impaired infants, visual cues may need appropriate enhancements.

Functional Vision Development

Process: Visual Attending Behaviors [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Watches lip movements	Calvello	Infant responds to normal and exaggerated lip movements by quieting, staring, or any other noticeable reaction.	Encourage interactive play with caregivers and infants. Enhance lips of women with lipstick for severely visually impaired infants. Infants can be encouraged to touch the face and/or lips as the caregiver speaks.
	Eyes follow object horizontally	Bayley 1&2	Stand behind infant with object at midline and 8 inches above eyes. Attract infant's attention and slowly move object to infant's right, left, and back to midline. Infant should be lying on back for this activity. Infant follows one complete excursion in up to three trials even if gaze breaks away once or twice. *(May need closer distance for infants with visual impairment.)*	Infant requires practice following objects that can be seen during daily routines (e.g., while eating). Infants with severe visual impairment may require enhanced objects against a high-contrast background. Sound may be added to encourage the infants to look. Some infants may need extra assistance at first by having a hand placed on an object as it moves in order to feel where it is going. Some infants may need very slow moving objects at first. (See comments under *Inspects Surroundings* on this chart.)
	Eyes follow object vertically	Bayley 1&2	Stand behind infant with object at midline and 8 inches above eyes. Attract infant's attention and slowly move object from infant's eyes to the forehead, to the chest, then lying on back for this activity. Infant follows one complete excursion in up to three trials, even if gaze breaks away once or twice. *(May need closer distance for infants with visual impairment.)*	Infant requires practice following objects that can be seen during daily routines (e.g., while eating). Infants with severe visual impairment may require enhanced objects against a high-contrast background. Sound may be added to encourage the infants to look. Some infants may need extra assistance at first by having a hand placed on an object as it moves in order to feel where it is going. Some infants may need very slow moving objects at first. (See comments under *Inspects Surroundings* on this chart.)

Functional Vision Development

Process: Visual Attending Behaviors [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Eyes follow object in circular path	Bayley 1&2	Stand behind infant with object at midline and 8 inches above eyes. Attract infant's attention and slowly move toy or ring in a circle about 12 inches in diameter and in a horizontal plane. Infant should be lying on back for this activity. Infant follows circular motion in upper and lower halves of circle even if in different trials. Allow three trials. *(May need closer distance for infants with visual impairment.)*	Infant requires practice following objects that can be seen during daily routines (e.g., while eating). Infants with severe visual impairment may require enhanced objects against a high-contrast background. Sound may be added to encourage the infants to look. (See comments under *Inspects Surroundings* on this chart.)
	Reacts to objects in the periphery	Glass	When infant is looking at something straight ahead and a brightly colored toy is moved in from the side to the infant's midline at a moderate rate, in an arc about 8 inches away, the infant responds by looking at or attempting to reach for toy. *(May need closer distance for infants with visual impairment.)*	Bring toys in from the sides to encourage viewing. Use visually enhanced or sound-making toys as necessary. Place infant's hands on objects that are at a distance to encourage reaching when appropriate. (See comments under *Inspects Surroundings* on this chart.)
	Glances from 1 object to another	Bayley 1&2 Glass	While lying infant on back with head propped to midline, hold bell in one hand and bell in other about 8 inches apart and 10-12 inches above infant's head with both objects in visual field. Gently shake one toy, then the other to make a soft sound. Alternate shaking three times, allowing several seconds between shakes for the infant's eyes to move from one toy to the other. Infant's eyes move from one toy to the other at least two times, even if gaze breaks away. *(May need closer distance for infants with visual impairment.)*	Provide these experiences with familiar sound-making objects during interactive play. Bring infant's hands to object rather than object to hands.

Functional Vision Development

Process: Visual Attending Behaviors [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Head follows object	Bayley 1&2	Have infant seated. Hold object level with infant's eyes and 12 to 15 inches away. Move it in a semicircular path to child's right, left, and midline. Infant turns head to follow object through one of three trials, even if gaze breaks away. *(May need closer distance for infants with visual impairment.)*	Infant requires practice following objects that can be seen. Infants with severe visual impairment may require enhanced objects against a high-contrast background. Sound may be added to encourage the infants to look.
	Regard small object briefly	Bayley 1&2	When seated at table, infant regards small object the size of a cube for at least 3 seconds. Tap near object to attract infant's attention. *(Object size will depend upon degree of visual impairment.)*	Infants require practice with small objects. Use touch as well as vision for infants with severe visual loss. Place objects on background of high contrast in initial training phase.
	Eyes follow ball rolling across table	Bayley 1&2	When seated at table, infant turns eyes or head to watch as ball moves across midline. Ball is 12 inches away. Attract infant's attention to ball if necessary. *(May need closer distance and large ball for infant with visual impairment.)*	Encourage child to watch moving objects during interactive play. Objects may require visual enhancement. Sound-making objects or wind-up toys may attract infant's visual attention. (See comments under *Inspects Surroundings* on this chart.)
	Inspects own hands	Bayley 1 Glass	Observe infant's behavior during periods of unstructured activity. Infant looks attentively at one or both hands.	Place textured half-mittens over hands, with or without toys attached, use colored cloth bracelets with bells sewn between two layers of fabric to encourage viewing. Encourage this skill in different body positions.

Functional Vision Development

Process: Visual Attending Behaviors [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 2	Attends to scribbling	Bayley 1&2	Place a piece of paper in front of infant on table. Take crayon and scribble plainly with obvious writing gestures. Let child hold crayon. Child attends to demonstrated scribbling or scribbles.	Provide experiences with markers and crayons. Place light paper with dark markers on light box for older infants with severe visual loss. Use scented markers to add olfactory cues.
	Reacts to toys at distance	Hyvarinen	Infant reacts to presentation of favorite silent toys, foods, etc. when presented from 5 feet away or more. Reaction can be change in expression, excitement level, activity level, etc.	Encourage infant to expand region of visual attention if vision is available for tasks outside arm's reach. Use visually enhanced and sound-making materials for training as necessary. (See comments under *Inspects Surroundings* on this chart.)

Functional Vision Development

Process: Visual Examining Behaviors

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Searches with eyes for sound	Bayley 1&2	With infant lying on back, prop infant's head up in midline position, being careful not to block ears. Stand away from infant's head out of direct line of sight. Ring bell to one side, then the other side, out of the infant's visual field and 18-24 inches away. If no response, repeat using a rattle. Infant's eyes or head move in apparent search for sound although not necessarily in the correct direction.	Bring infant's hands to sound-making objects rather than objects to the infant to reinforce the concept of their position in space. Begin by sounding object while in infant's hands or while infant's hands are in contact with toy that is touching body. Encourage movement to the object by touching the infant's shoulder (not the hand) to assist the infant in a reaching motion whenever possible.
	Visually recognizes caregiver *(in Cognitive Development section although recognition need not be visual there)*	Bayley 1&2	Infant visually differentiates caregiver from stranger when stranger moves from field of view and caregiver then enters it. Infant has animated expression or pays particular attention to caregiver.	Caregiver uses a consistent greeting to begin interaction with the infant.
	Reacts to disappearance of face	Bayley 1&2	When infant's attention is attracted to caregiver's face, infant changes facial expression or reacts in any other way when caregiver quickly moves out of infant's range of vision.	Encourage infant to look at caregiver's face. Bring face closer to infant with severe visual impairment. Women can wear lipstick to enhance contrast. Bring infant's hand to caregiver's face to reinforce and to encourage exploration.
	Displays visual preference	Bayley 2	Present a card on which there is a simple pattern versus a card with a complex pattern (e.g., bold, black cross on white background versus thin black and white striped pattern.) Infant looks longer at complex pattern.	Infant begins to show preferences. Continue exposure to functional stimuli the infant finds interesting.
	Turns head to sound	Bayley 1&2	Standing behind seated infant, ring bell or shake rattle 12-14 inches from one ear, then the other ear. Repeat if necessary. Infant purposely turns head to sound at least once in three trials.	Based upon earlier experiences with sound-making objects. When child turns, touch hands to object.

Functional Vision Development

Process: Visual Examining Behaviors [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 2	Looks for fallen objects	Bayley 1&2 VIIRC	Hold toy near table edge and let it drop while infant is attending. Repeat if response is not clear. Infant turns head to look for fallen toy.	Based upon earlier experiences involving vision and cognition. Provide experiences for infant following objects moving in different directions. Objects may require visual enhancement. (See comments under *Inspects Surroundings* in Visual Attending Behaviors chart)
Cluster 3	Looks at pictures *(Looking at 2-dimensional objects may come very slowly for some infants with visual impairment.)*	Bayley 1&2	When presented with large, clear pictures in bright colors with simple lines, infant looks at specific pictures rather than quickly leafing through book. Encourage infant to look. Help hold the book for infant if necessary.	Provide experiences with pictures. Discuss the pictures during interactive play. Provide picture books for solitary play as appropriate. Use books with textures, sound effects, and peek-a-boo windows. For older infants with severe vision loss, large outlined pictures on a light box may be the initial step.
	Looks for contents in container	Bayley 1&2	Place small object in container, and rattle container. Take objects out of container and place in front of infant. Replace objects in container and rattle again. Remove objects from container out of the infant's field of vision. Hand the container to the infant. Infant looks into the container for objects before reaching inside.	Provide opportunities for the infant to play with containers such as pots, pans, and plastic tubs along with safe objects that can be placed into and dumped out of them.
Cluster 6	Identifies family members at a distance	Hyvarinen	Infant can name a family member using vision from 7 feet away or more.	Encourage infant to locate and examine objects at a distance within infant's visual capabilities. Add visual enhancement or sound as necessary during training. Develop a "Who's that?" game or ask the infant "Where's Mommy?", etc. (See comments under *Inspects Surroundings* in Visual Attending Behaviors chart.)

Functional Vision Development

Process: Visually Guided Motor Behaviors

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 1	Bats at dangling toy	Glass	When lying on back with a toy hanging overhead 8 inches away, infant swings at toy with hand when both hand and toy are in visual field. *(May need closer distance for infants with visual impairment.)*	Provide an environment in which toys are in the infant's field of view, are readily detectable, given the infant's visual impairment, and are within arm's reach. Toys should be positioned so that they are not directly in front of the eyes (slightly under eyes and to the right or left if the infant is lying down). In this way, the infant can choose to look at or disregard the toys. (See comments under *Inspects Surroundings* in Visual Attending Behaviors chart.)
	Reaches for dangling toy	Bayley 1&2	While lying down, infant reaches for toy hanging about 8 inches above infant's eyes. Need not grasp toy. *(May need closer distance for infants with visual impairment.)*	Encourage reaching to sound-making objects. Bring infant's hands to sound source. Provide graspable hanging toys during supervised play only to ensure safety. Position toys so that child can choose to look at them or look away (i.e., not directly in front of eyes). Graspable hanging toys can include canning rings, textured thick, ribbon, pony tail ribbons. (See comments under *Inspects Surroundings* in Visual Attending Behaviors chart.)
Cluster 2	Reaches for caregiver's face	Calvello	Infant reaches toward caregiver's mouth, nose, glasses, etc.	Based upon interaction with caregiver and earlier experiences viewing and touching caregiver's face.
	Manipulates object with visual interest in object details	Bayley 1&2	Hold sound-making object in front of seated infant. Sound the object and set it in front of infant. Repeat if infant does not pick up object and hand object to infant. Infant manipulates object while visually examining details.	Encourage infant to play with objects that provide sufficient visual feedback to promote prolonged visual attention. This will vary with each infant's visual needs.
Cluster 3	Imitates movements	Bayley 1&2	Caregiver pats unfamiliar toy on table in front of infant to elicit sound several times. Infant imitates motion.	Encourage infant to imitate movements with objects that result in a rewarding experience (e.g., sound, vibration, light, etc.)

Functional Vision Development

Process: Visually Guided Motor Behaviors [Continued]

CLUSTER	INDICATOR	SOURCE	CLARIFICATION	SUGGESTIONS FOR INTERVENTION
Cluster 5	Scribbles spontaneously	Bayley 2	Place paper on table in front of infant with crayon on paper and the crayon tip pointing away. Infant spontaneously scribbles without demonstration or encouragement.	Encourage infant to draw with crayons, markers, scented markers, as well as paint with brushes or finger paint. Use pudding or paint mixed with sand.
Cluster 6	Points to two large pictures in book	Bayley 2	When presented with large, clear pictures in bright colors with simple lines, infant names, points, or touches two pictures as they are named. The infant can identify unfamiliar pictures as well as familiar ones.	Provide infant with a variety of picture books, books with textures, books with auditory feedback, peek-a-boo books, and books that have accompanying audiotapes.
	Imitates crayon stroke	Bayley 2	Place paper on table in front of infant with crayon on paper and the crayon tip pointing away. Adult can assist in holding paper. Draw a vertical line and ask infant to copy it (e.g., Can you do it?) Then draw a horizontal line and ask infant to copy it. Infant produces stroke in any direction.	Based upon earlier experiences with crayons and markers. Encourage scribbling, imitation of strokes in interactive play.
	Matches objects with pictures of those objects	Oregon	When handed objects, one at a time, infant matches three objects with corresponding pictures that are large and clear, with simple lines. Task should be demonstrated once to the infant using a different picture/object pair. Infant can point, name, or physically position objects to match pairs.	Engage in interactions in which infant matches objects to objects and objects to pictures.

Functional Vision Development

SOURCE	POPULATION	TYPE
Bayley 1	normally sighted infants	standardized infant development scale
Bayley 2	normally sighted infants	standardized infant development scale
Calvello	normally sighted infants and infants with visual impairment	literature review
Glass	normally sighted infants who are full term and premature	literature review
Hyvarinen	infants with visual impairment	literature review and observational report
Oregon	infants who are visually impaired or totally blind	literature review: field test for content validity
VIIRC	infants who are totally blind, visually impaired; includes premature infants; multiple disabilities data available but not included here	research study

RESOURCES

USE OF GUIDELINES TO DEVELOP INTERVENTION GOALS AND STRATEGIES

DEVELOPMENTAL CHART SOURCES

SELECTED RESOURCES FOR ADDITIONAL READING

Use of Guidelines to Develop Intervention Goals and Strategies

This chapter provides examples of how the developmental guidelines may be used to develop intervention goals and strategies for infants with visual impairment. First, the early interventionist should be familiar with the purpose, content, and organization of this manual. Next, information on an infant should be gathered from multiple sources including caregiver interview, informal and structured observations, and review of previous and current reports. These data along with family concerns and priorities and professional judgement should provide the foundation for developing necessary interventions. In addition, the infant's strengths and interests should provide the basis for developing meaningful and motivating interventions that address areas of concern.

Sample Vignettes

The manual may be used as a reference to identify intervention concerns, goals, and strategies for an individual infant with visual impairment. Two vignettes are presented with a brief description of each infant and family. Current developmental strengths, intervention concerns, and intervention suggestions are noted on summary sheets.

Vignette 1: ***Casey***

Casey is a 15-month-old boy who has just been referred to an early intervention program serving infants with visual impairment. He lives with his mother, two older sisters (ages 3 and 5 years), aunt, and grandmother. As a result of meningitis at 3 months of age, Casey was diagnosed as having a cortical visual impairment, developmental delays, and hypotonia. He is often congested and prone to respiratory infections.

Casey smiles when he hears his mother's voice and when his sisters kiss his cheeks. He makes some babbling sounds ("ah, ah, ah," and "da, da, da"). Casey can maintain a sitting position if supported at the hips. He sits in a high chair supported with a foam insert. He eats the pureed baby food that his mother feeds him and has begun to reach for the spoon when his mother offers him a bite of food. He cooperates with hand-over-hand assistance to activate a musical toy by pushing on the lid.

A functional vision report notes that Casey attends to light, and nystagmus was elicited in response to the Optokinetic drum. His physical therapy report contains suggestions for positioning and handling to increase his alertness and to maintain his balance. Casey seems to have a low physical activity level. His sleep and feeding schedule are regular. He enjoys his bottle and pureed food. His mother reports that "he is quite an easy baby except for the physical care that he requires."

Casey's mother is concerned about his motor and communication development. She has said, "It would make a big difference if Casey could keep healthy and learn how to feed himself, walk, and talk." Given these priorities, interventions are needed to support Casey's development in all areas within the context of daily routines. For example, since mealtime is a favorite activity, Casey can be encouraged to make vocal or gestural requests and to use visually guided motor and visual examining behaviors. His mother does not want him to attend any center-based program "until he is older and stronger."

Summary of Developmental Strengths and Intervention Concerns

Name: Casey Hamilton
Interviewer: Mary Jones, Early Interventionist
Observation Date: May 01, 1996

DOB: February 01, 1995
Program: ABC Infant Program
Setting: Home

Informant: Maxine Hamilton, Mother

DEVELOPMENTAL AREA	STRENGTHS	CONCERNS	INTERVENTIONS SUGGESTIONS
Cognitive	Casey cooperates when grasping a rattle and helped to shake it. He quiets when he hears sound toys. He anticipates when his mother is about to pick him up by moving his head forward.	Casey needs encouragement to reach for and grasp desired objects.	Provide meaningful and motivating opportunities for manipulating toys that make sounds and have different textures (e.g., rubber squeeze toys) and finger feeding different soft foods. Provide toys that will remain within his reach (e.g., hanging mobile, suction toy on high chair tray).
Social and Emotional	Casey smiles when an adult speaks to him using an exaggerated intonation.	It is not clear whether Casey discriminates his mother from his aunt and grandmother because they are all involved in his caregiving.	Help Casey identify familiar adults by selecting specific characteristics to be used as "greeting cues" (e.g., pull on aunt's long hair, touch grandma's glasses, and mother's greeting "How's my boy?") Develop similar cues for each of his sisters (e.g., one can greet him with a kiss on his cheek and the other with a tickle on his chest).
Communication	Casey makes a few babbling sounds "ah, ah, ah" and "da, da, da." He cooperates when guided through a variety of activities.	Casey is a quiet baby who demonstrates mild reactions to people, activities, and objects. Consequently, he does not appear to have strong likes or dislikes. Systematic observation is needed to identify his preferences (other than food) that can be used to motivate communication. He has had a couple of ear infections this year. However, he had a hearing test last month and seems to respond to a variety of sounds.	Develop vocal play games using Casey's sounds and providing opportunities for turn taking. Add a tactile and/or movement component to the vocal play (e.g., clap hands, bounce, or dance together). Identify and respond to signals that Casey wants game to continue. Offer Casey a choice between his bottle and bowl of applesauce. Have him touch each of them and select which to have first. Identify Casey's communicative behaviors, interpret and respond to them. Introduce selected signs for preferred people and activities (e.g., MAMA, EAT).

Summary of Developmental Strengths and Intervention Concerns [Continued]

DEVELOPMENTAL AREA	STRENGTHS	CONCERNS	INTERVENTIONS SUGGESTIONS
Fine Motor	Casey uses his whole hand to grasp and hold objects placed in his hand. He is beginning to reach for objects.	Casey needs to be encouraged to use both hands to hold and manipulate objects.	Develop a game of turn taking by taking objects out of a container (e.g., sound toys that are easy to grasp).
Gross Motor	Casey sits with support at the hips. He rolls from his back to stomach. When placed on tummy he attempts to move forward by crawling.	Casey needs opportunities to work on his sitting balance and crawling.	Team with Casey's physical therapist to develop strategies for supporting Casey's sitting balance and crawling during other daily activities (e.g., crawling toward a desired sound-making toy). Decide when Casey can work on two skills at once (e.g., on sitting unsupported and looking at a favorite sound toy) and when he needs to focus on just one (e.g., holding and drinking his bottle requires support while sitting).
Vision Functioning	Casey attends to light (e.g., ceiling lights, bright sunlight through a window). He reaches for and touches his red bowl at mealtimes. He tries to grasp the spoon as his mother feeds him.	Casey seems to respond inconsistently to objects and people. Sometimes he seems visually attentive and other times he does not. Additional systematic observation is needed during caregiving and play routines to identify Casey's visual field, color preferences, the size of objects that he can see, and from what distance.	Select familiar objects in different colors that will be used consistently to assist Casey's visual recognition (e.g., red bowl, yellow bottle, orange sound toy). During the natural routine, present the object and give Casey time to attend, look, reach, and grasp (e.g., his yellow bottle during meals). Develop a game to help Casey search for and locate a favorite orange sound toy (e.g., "Where's your.....? Let's look. There it is.").

Vignette 2: *Mary Ann*

Mary Ann is a 23-month-old girl who participates in a home-based intervention program for infants with visual impairment and their families. She is an only child of a two parent family. Mary Ann was born 3 months premature and weighed 2 lbs at birth. She has been diagnosed with retinopathy of prematurity which resulted in bilateral retinal detachment.

Mary Ann walked independently at 9 months corrected age. She climbs out of her crib and gets up on the sofa, goes up and down stairs without help, and wanders around the house. Her motor development is an area of strength. She enjoys active play on swings, slides, and trampolines.

She does not play with objects but tends to bite them, and she dislikes touching a variety of textures including food. She protests and cries if her mother or early interventionist encourages her to play with toys (xylophone and stick, musical toys, textured blocks). She prefers to be left alone and will go to her room when she hears the early interventionist arrive for the home visit. Mary Ann likes music and songs. She will cooperate with pat-a-cake and other finger plays with her mother using hand-over-hand assistance.

Mary Ann discriminates between familiar people by their voices and tends to imitate some of her mother's comments (e.g. "This is a comb" while holding a comb). She responds appropriately to familiar spoken requests (e.g., "Sit down," "Come to Mama") and uses one-word phrases for requesting favorite objects and activities (e.g. "Music," "Row-Row," "Rocking-horse"). Mary Ann has not had much interaction with other children. There are no young children in her extended family, and her family has not taken her to the church nursery or the park because of her unpredictable behavior (i.e., will cry, pinch, and bite others when upset).

Mary Ann seems to have a high physical activity level. Her sleep and feeding schedule are irregular. She take short naps during the day and then is awake at night. She is not very interested in food. Mary Ann tends to reject anything new or unfamiliar (person, song, object, food), and does not adapt easily to new situations.

Her parents describe her as an active child who is happy if left alone. They are concerned about her irritable behaviors which seem to increase when she is around unfamiliar people. They would like her to sleep at night and learn to play with other children. Her parents do not want her to attend a center-based program for infants with visual impairment mainly because of the distance and bus ride. Her mother is interested in participating in a weekly parent/toddler playgroup at their neighborhood community center which is within walking distance from their home. The early interventionist will accompany Mary Ann and her mother to the playgroup to support their participation. In addition, she will consult with the speech and language therapist and orientation and mobility specialist at her program regarding Mary Ann's language and mobility skills and needs.

Summary of Developmental Strengths and Intervention Concerns

Name: Mary Ann Davis
Interviewer: Deborah Chen, Early Interventionist
Observation Date: April 24, 1996

DOB: March 20, 1994
Program: ABC Preschool
Setting: Home

Informant: Silvia Davis, Mother

DEVELOPMENTAL AREA	STRENGTHS	CONCERNS	INTERVENTIONS SUGGESTIONS
Cognitive	Mary Ann moves towards her parents when they call her. She locates familiar objects around the house.	She bangs toys on surfaces or bites them and dislikes touching a variety of textures. She cries and tenses her body if hand-over-hand guidance is used to help her manipulate toys (e.g., to hit the xylophone with a stick).	Provide opportunities for Mary Ann to handle and manipulate objects in meaningful and motivating situations (e.g., to help put a tape in her Tiny Tikes cassette player, push the button to turn it on, put on her shoes to go outside).
Social and Emotional	Mary Ann differentiates between familiar and unfamiliar people. She moves independently around her home. She cooperates with action songs.	She waits for her mother to call her to initiate contact, otherwise she would spend all day in her bedroom or walking around the house. She takes brief naps in the day and is awake at night. Parents describe her behavior as "fine when alone but irritable when we try to get her to do anything. She will cry, pinch, and bite when she is upset."	Develop a predictable daily routine for Mary Ann with clear opportunities for active participation in simple tasks (e.g., getting her shoes and putting them on, asking her to get her sweater when getting ready to go out, having her put her toys in the basket when she is finished playing). Play "hide and seek" games involving movement away from caregivers and then seeking contact (e.g., "Where's Mary? There she is!"; "I'm coming to get you"; Find Mommy."). Support participation at a playgroup with sighted peers. Begin with encouraging interactions on play equipment (e.g., take turns on a slide, ride together on a rocking boat, climb through a tunnel). Develop a bedtime routine (e.g., take a bath, read a story, listen to music in bed, get a goodnight snuggle, go to sleep).

Summary of Developmental Strengths and Intervention Concerns [Continued]

DEVELOPMENTAL AREA	STRENGTHS	CONCERNS	INTERVENTIONS SUGGESTIONS
Communication	Mary Ann recognizes familiar words and phrases (e.g., "Come to Mommy.", "Deborah's here."). She responds to familiar requests (e.g., "Wave bye-bye.", "Give Daddy a kiss."). She imitates one word after a model and anticipates familiar routines in response to requests (e.g., "Let's go to Auntie's house."). She uses one- word phrases to request favorite toys or activities (e.g., "Row-Row," and "Music").	She communicates mainly to protest, refuse, or reject the action of others on her; or to request an object or activity. She needs encouragement to engage in communication for social interaction and joint attention purposes. She repeats what mother says to take a turn in the conversation.	Build on Mary Ann's requests for favorite actions songs by adding other opportunities for social interaction (e.g., "hide and seek" games as discussed previously). Use progressively matched turntaking to expand on Mary Ann's actions and words (e.g., when she sits on the rocking horse, say "Go for a ride on the horsey."). Describe her actions on objects (e.g., "You're riding fast."). Comment on Mary Ann's behaviors (e.g., "You like the horsey."). Consult with the program's speech and language therapist regarding other strategies to support Mary Ann's language development.
Fine Motor	Mary Ann can pick up cereal and finger feed herself although she protests. She claps her hands in action songs with verbal prompts. She plays with toys by banging them on surfaces.	She dislikes touching a variety of textures such as sand, fingerpaint, and textured puzzle pieces. She pulls her hands away when her mother tries to assist her in manipulating and exploring objects and will begin to cry if her mother persists.	Provide opportunities to explore textures in meaningful situations (e.g., picking out clothing she will put on, selecting toys at play time, choosing snacks to eat). Provide musical toys that motivate use of both hands. Use music to support Mary Ann's tactile exploration of objects (e.g., during water play, sing "This is the way we squeeze the sponge, squeeze the sponge, squeeze the sponge..."). Identify the type of prompt (verbal, tactile, physical) that is most likely to elicit Mary Ann's manipulation and exploration of objects. Offer container of household objects with different textures (e.g., wire wisk, wooden spoon, powder puff, plastic brush).
Gross Motor	In familiar places, Mary Ann walks independently and moves around barriers. She walks up and down stairs using the railing for support. She explores her house by cruising along the sofa, coffee table and cabinets.	In places other than her home, Mary Ann tends to stay in one place unless an adult guides her to explore the environment.	An orientation and mobility specialist should be involved in developing a program for encouraging Mary Ann's safe and independent mobility across a variety of settings.

Summary of Developmental Strengths and Intervention Concerns

Name: DOB: Informant:

Interviewer: Program:

Observation Date: Setting:

DEVELOPMENTAL AREA	STRENGTHS	CONCERNS	INTERVENTIONS SUGGESTIONS
Cognitive			
Social and Emotional			
Communication			

Summary of Developmental Strengths and Intervention Concerns [Continued]

Name: DOB: Informant:
Interviewer: Program:
Observation Date: Setting:

DEVELOPMENTAL AREA	STRENGTHS	CONCERNS	INTERVENTIONS SUGGESTIONS
Fine Motor			
Gross Motor			
Vision Functioning			

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